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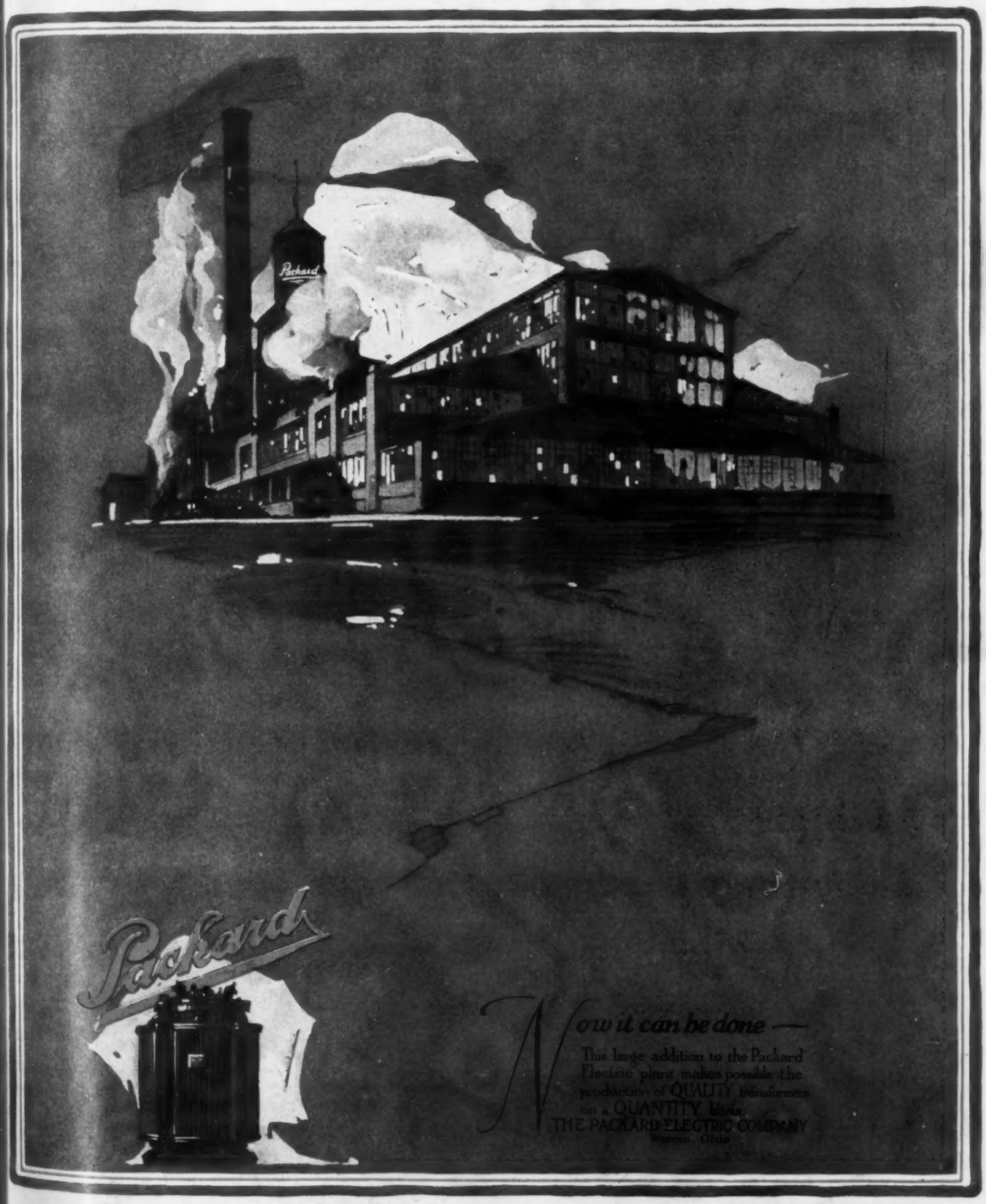
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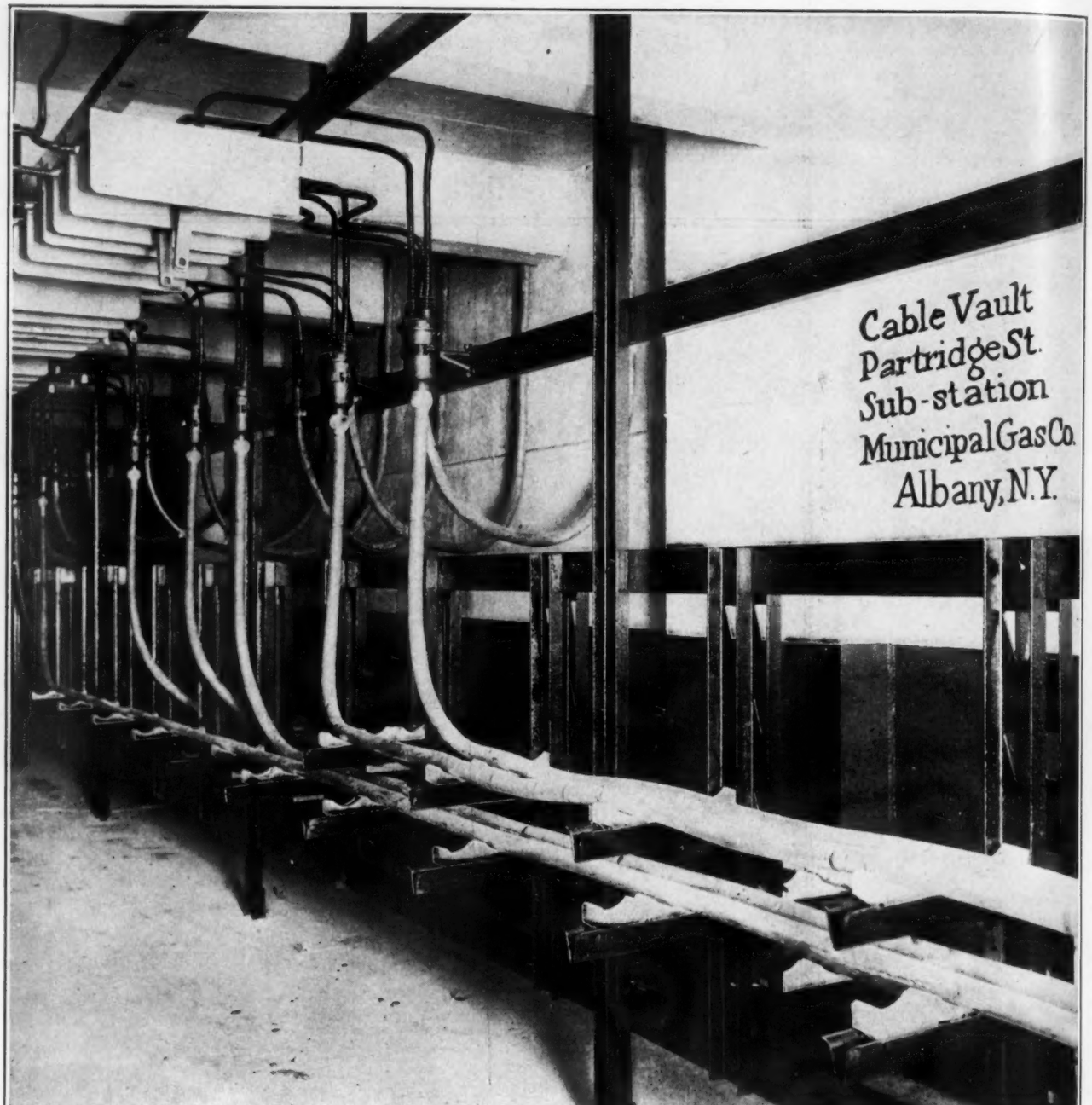

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Electrical World

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Washington Shows Signs of Coming to Its Senses

THE past few weeks at Washington have been enough to sicken any good American who has a sense of proportion, of justice and fairness and of pride. How some senators, chosen to membership in what the nation used to boast was the most august body in the world, can so forget themselves in an attempt to uncover corruption—to give them full benefit of doubt—as to resort to a mud-slinging contest by exploiting the gossip of already discredited "witnesses" is beyond comprehension. As a result, the electrical industry among others has commenced to feel the nation-wide reaction to this sort of behavior by government officials charged with the serious business of running the country. As a direct result of Washington disturbances there appears everywhere to be a lull in industry brought on by uneasiness as to what our institutions may be coming to and by uncertainty as to what fiscal and business legislation, if any, will be enacted. Happily, this reported lull is accompanied by great confidence in the future; but it is none the less a serious situation when business may be so upset by mistaken performances on the part of public representatives. This is not to belittle the good achieved by the investigations in ridding the government of some office holders who fell short in the vital matters of ability and fitness, if not in integrity; but this fortunate result could have been attained without the deplorable behavior that accompanied and followed it.

It is a relief to learn that such tactics are over—that pressure of public sentiment has made itself felt—and there will doubtless be further evidence of the public resentment at future elections. Industry will immediately respond favorably to the knowledge that there are again symptoms of intelligence in Washington, and there will be justification of the confidence that essentially our government and its institutions are sound, that we have not actually retrogressed but are constantly effecting progress, and also that public opinion is finally the ruling force in this country.

Making Central-Station Service Unanimous

LEADING manufacturers in the Naugatuck Valley of Connecticut, the center of brass melting and fabricating interests of great magnitude, have decided henceforth to purchase central-station energy as a matter of course instead of extending their own power plants to meet the rapidly growing demand for service. This decision has been reached by a group of industrialists whose opinions and conclusions carry widespread influence in their field, and it therefore constitutes an indorsement of central-station energy that is highly significant. It is not surprising that purchased power should make striking headway in the metallurgical processes, material handling, machinery operation and illumination of individual plants in the "brass belt," but it is a long step forward in economic betterment when such a group of manufacturers arrives at so clear-cut a conclusion. The new Devon station of the Connecticut Light & Power Company is an answer to the demands of such customers in this important industrial region.

Very gratifying it is to reflect that, in the face of an "industry decision" like the foregoing, a vast amount of time and effort will be saved in applying central-station service in contrast with the older days, when the problems of every installation had to be attacked as it were by main strength, and when comparison between the costs of isolated-plant service and those of purchased power deeply and often inconveniently absorbed the attention of executives. Here is a merited triumph of central-station service based on experience and destined to contribute more powerfully to the public welfare as its use is extended.

The Administration of the Patents Is the Point at Issue

THE most widely used of all electrical appliances, the symbol of electric service indeed, is the incandescent electric lamp, and it is to be expected that anything affecting its manufacture, distribution or cost will be of prime interest in the electrical industry. It is important therefore that there be a clear conception throughout the industry of what the government's recently filed suit against the General Electric and the Westinghouse lamp companies really involves and what a decision one way or the other may portend.

In the first place, this suit is not with reference to patent rights—the courts have spoken frequently on that point and have just recently resustained the Just and Hanaman patents, which expire in 1929. The Coolidge patent (expiring 1930) and the Langmuir patent (expiring 1933) have also been adjudicated in favor of the owner, the General Electric Company. What the pending suit is to determine is whether two freely admitted practices are illegal or not—one the present agency-contract, consigned-stock, controlled-price method by which the lamps are distributed, and the other the license arrangements by which the Westinghouse company and other licensees are permitted to manufacture a certain percentage of the lamps and required to sell them at the General Electric's price.

The columns of the press are not the place to try patent suits, nor to predict judicial decisions. But the general satisfaction of the industry with the present method of handling lamps, and also the various price reductions which have brought the cost of lamps far below pre-war prices, will doubtless be brought out as

the case progresses. The General Electric Company has an admitted patent monopoly of the present "Mazda" lamp business. What is to be decided is whether its administration of the patents is within the law.

The Horse Industry Shows Signs of Fear

THE Horse Association of America has been writing letters. The very natural purpose of these letters, sent to truck owners with appended data, was to advocate the use of horses for hauling in city traffic, and they argued among other advantages a saving of from 40 to 80 per cent per ton over the cost of using motor trucks. So far so good.

But the method employed was rather surprising. It consisted of an out-and-out attack on the electric truck, first by presenting alleged advantages of gas trucks over electric trucks and then proceeding to damn the electric truck by listing an alarming array of weaknesses in the electric storage battery—so staggering, in fact, that any one who credits them could not but wonder how an electric truck ever drags itself home. The case was clinched with the statement that electric light and power companies use gas trucks and the naming of a few industrial houses that have abandoned "electrics." The letters failed to mention the American Railway Express Company, with its 1,500 battery-driven trucks, or any other well-known fleet, nor did they allude to the conspicuous growth of electric truck sales in the last few years.

It would seem that the Horse Association is beginning seriously to fear the competition of the electric truck. This is worth the notice of those central-station executives who still stand aloof. It is a pity, though, that the horse cannot write these letters for himself, because with his sturdy honesty and kindliness he would speak only of the things that he can do, how he himself can still serve man, and this would do the horse more good than malicious flings at the storage battery.

A Pet Merchandising Theory Upset

FOR a long time the electrical contractor-dealers have contended that if the central-station company would refrain from selling electrical appliances they, the contractors, would be able to do a greater volume of appliance business and earn a real profit therefrom. Directly contradicting this idea are the tabulated sales of electrical appliances by the contractor-dealers in two cities where the local central-station companies do not merchandise. In the ELECTRICAL WORLD series on "Who Sells Electrical Appliances?" city number VII, covered in the article on page 471 of this issue, and city number VI, covered in the March 22 issue, are both places in which the central stations practice a non-merchandising policy. In each of these cities the contractor-dealers account for only 3.5 per cent of all appliance sales while non-electrical dealers are doing about half of the business, the rest of the volume being handled by electric shops (with no wiring department) and specialty stores. On the other hand, in five other cities and smaller towns investigated, where the central stations were merchandising, contractor-dealers' sales range from 6 per cent to as much as 31 per cent of the total. These two cities (VI and VII), by the way, were surveyed by different men, and the cities are three thousand miles apart. In both of them, in spite of the fact that the field was left open to them, the contractor-dealers were disgruntled concerning the merchandising business and were inclined to abandon the sale of appliances. It was not that the contractor-dealers were unsuccessful in their total business, but primarily they were interested in and engaged in the contracting and wiring business, not in the sale of specialties.

These figures tend to show rather conclusively that the contractor-dealer does not benefit by the central station retiring from the merchandising business. In other words, no business gravitates automatically to the contractor-dealer because the central station does not merchandise. On the contrary, it is more likely—and in fact the figures for some of the other cities seem to prove it—that, instead of hindering the contractor-dealer by selling appliances, the central-station company can be, and frequently is, a very material help to him as well as to all other local dealers in electrical appliances by setting up a definite and constructive merchandising standard and policy.

More Confidence in Alternating-Current Networks

IN MANY cities engineers are studying energy distribution in an attempt to reach the solution that will most satisfactorily meet present and future needs. The great investments in transformers, substations, wires and cables in themselves call for serious attention to possible economies, but in addition there are major problems connected with maintaining uninterrupted service and obtaining a system which will fit in with the physical conditions found in modern cities of large size.

Two general trends are to be noticed in reported activities. One is toward higher voltages, such as 13,200 for overhead lines and as high as 33,000 for underground cables (not neglecting the Cleveland 66-kv. cable, which is primarily for transmission, not distribution), and the other is toward the use of secondary alternating-current network connections. The higher voltages contemplated result from the necessity to reduce investment and to meet the great increases in load demands in areas where physical restrictions are placed on the number of substations or amount of copper that can be used. The use of secondary networks offers possibilities for great economies and for better service in nearly all cities, and the practice of supplying groups of urban consumers from single transformers is passing. Secondary networks reduce the primary copper losses and investment, especially in four-wire systems where the same neutral serves for both the primary and secondary. Their other major advantages include reduction in transformer kva. and increase of transformer load factor through obtaining greater diversity; reduction in transformer costs and core and copper losses, because larger units can be used; reduction in maintenance and installation charges; greater reliability in service, because each consumer is fed from multiple points; greater ease in taking on loads; better voltage regulation, because of diversity and less secondary drop, and a greater revenue to the company, because of the higher continuity of service, reduced losses and better regulation.

However, the secondary network is not yet wholly satisfactory as a practical operating accomplishment, and it still ranks below the Edison network in simplicity and reliability. It is difficult to isolate trouble on an alternating-current network, and the apparatus that has been developed to meet this situation is still unstandardized. Connecting the same secondary phases on existing single-phase, three-wire systems together and using fuses for protection and isolation have been found to give rather unsatisfactory results, for the transformers cannot be fused in a way to protect them against overloads, if service is to be maintained. Moreover, when fuses do blow, a long interruption to service results as it is difficult to re-fuse a network or locate the trouble point. To improve upon the fuse several network protective devices and schemes have been developed both by light and power company engineers and by manufacturers of electrical apparatus. Most of these utilize reverse-energy relay and transformer principles to blow fuses or actuate breakers, and all have yet to be tried out under all operating conditions for a long period of time. Some of them work only on single feeders, but others have been developed for application to multiple feeders. Satisfactory reports are given by users of all the types, and in a short time this greatest stumbling block to network alternating-current distribution will have been passed. The ultimate device must be reliable, cheap and automatic in its protective features in addition to conforming to safety, fire and space limitations, and while none of the existing protective systems qualifies as yet to the complete satisfaction of distribution engineers, yet they can safely adopt this type of distribution in full confidence that manufacturers and engineers together will develop the equipment which is necessary for its satisfactory operation.

Arch-Dam Tests to Supply Much-Needed Data

IT HAS long been recognized by engineers that there is a paucity of accurate design data on arch dams and that because of this lack of information dams have been made more massive and more materials have been used than were really necessary, with the result of greatly enhanced costs. Arch dams have been used for centuries, but their design is still largely a matter of theory, and although there is no instance on record of the failure of a concrete or other masonry-arch dam, it is not known what factor of safety actually exists in any such structure. The unit stress generally adopted in design is much lower than the unit stress used for other types of concrete structures where the design has been proved by experimental work. Any such experiment has been much more than a laboratory exercise.

But with the data which will be made available by the study of the experimental arch dam to be built in California—as reported on another page—coupled with the results of research by the Engineering Foundation as to deflection and other deformation of existing dams, it will be possible to design structures economically and at the same time provide for an ample factor of safety. This may even make possible the construction of power, irrigation and other projects where the cost of an impounding dam is now prohibitive. This practical field test will be watched with keen interest in engineering circles the world over, the value of the results of such a test being instantly appreciated.

Ontario and Quebec as Reflected by Dominion Statistics

WHILE the report of the Gregory commission of inquiry on the Hydro-Electric Power Commission of Ontario is fresh in mind, it is interesting to compare with its conclusions, or rather with some of its statements, an analysis of the report of a permanent official Canadian body, the Dominion Bureau of Statistics. As the ELECTRICAL WORLD pointed out last week, the Gregory report, granting wonderful engineering excellence of conception, granting that Sir Adam Beck made popular and useful extensions of service into sparsely settled territory, finds that the real fault lay in the business side of the administration—the excessive cost—thus confirming the principal point of negative criticism by all unbiased students of the commission's activities. A similar conclusion of excess cost results, as do other instructive comparisons, from an analysis of the report of the Bureau of Statistics, which was abstracted briefly in the ELECTRICAL WORLD for March 22, page 593.

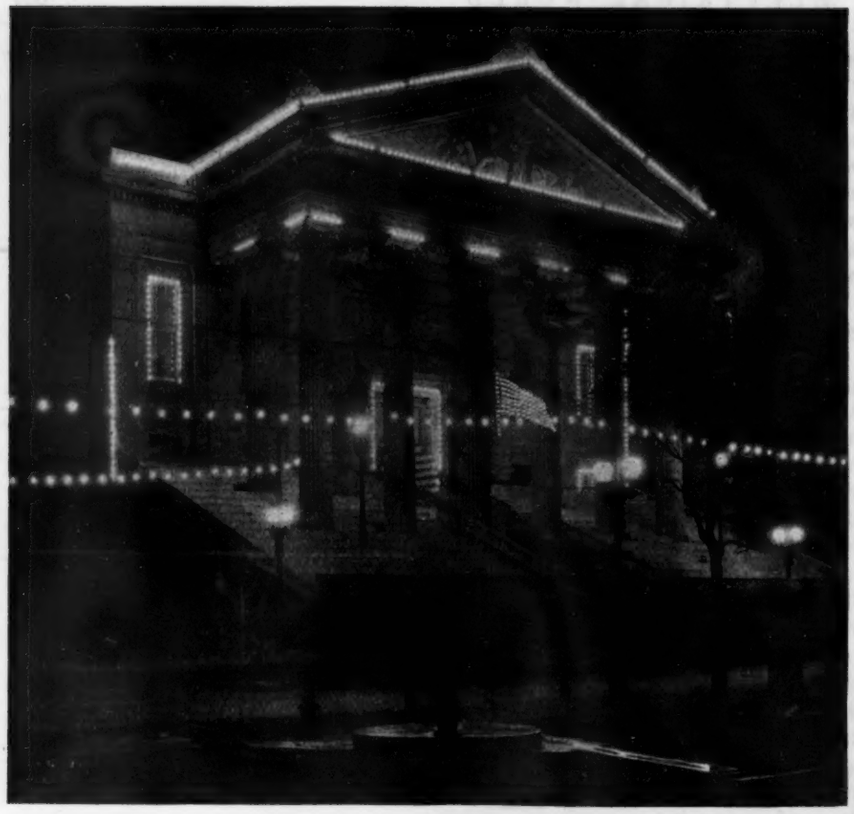
In the following table Ontario and Quebec (the latter province approaching Ontario very closely in its electrical development) are compared on the unit basis of 1,000 kw.-hr. generated or 1,000,000 kw.-hr. generated as the case may be, because in the end the kilowatt-hour is the basis of the measure of income and is a significant point of departure for most analyses. The figures are for 1922:

	Ontario	Quebec	Ontario Compared with Quebec, Per Cent Greater
Capital investment per 1,000 kw.-hr. generated	$93.00	$65.60	42
Revenue per 1,000 kw.-hr. generated	$12.82	$8.46	51
Expense per 1,000 kw.-hr. generated	$8.34	$4.68	78
Employees per 1,000,000 kw.-hr. generated	1.68	0.96	75
Miles of line per 1,000,000 kw.-hr. generated	3.18	1.92	65
Kw.-hr. generated per customer	7,137	8,850	30*
Operating ratio or expense divided by revenue, per cent	65	55	18

* Less.

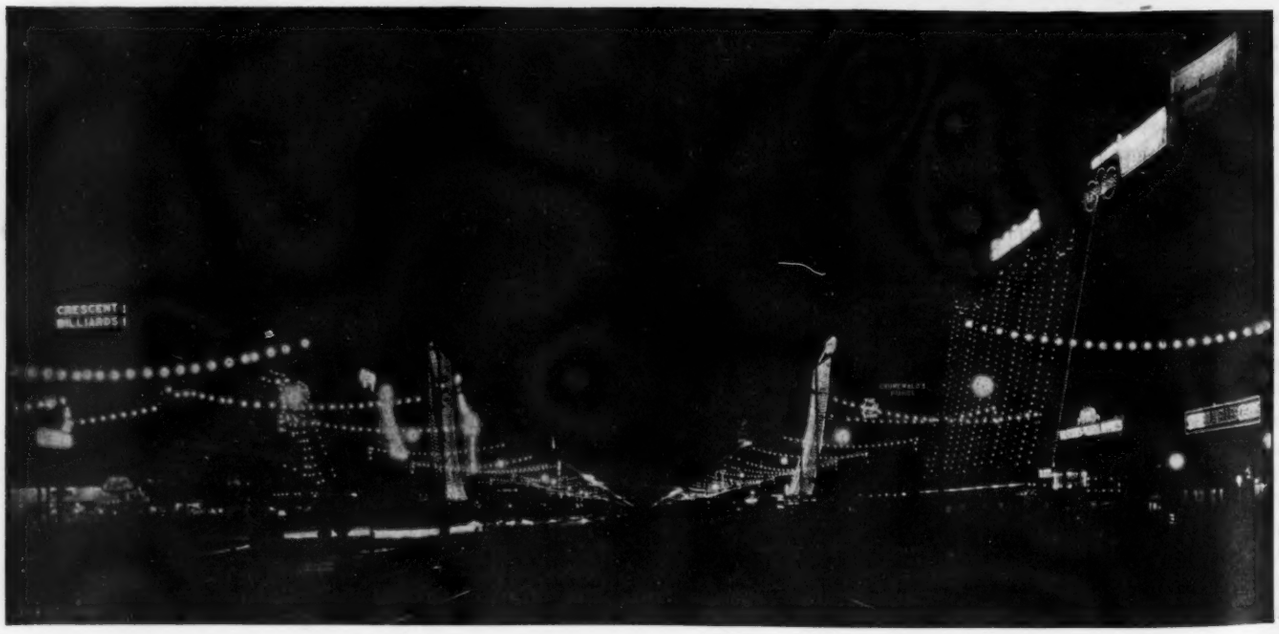
It should not be necessary to offer much comment on this tabulation made from figures from official sources. To be sure, no one of these figures, nor, for that matter, all of them together, tells the whole story, as there are many other elements to consider. But, taken as a whole, no one can avoid the conclusion that, however great in conception the work of the Ontario Hydro commission has been, the economic cost to the community has been excessive, and this fact does much to rob the people of the benefits of the development.

A question will doubtless occur to many who have followed the record of the Ontario Hydro's development as to how closely these results correspond to similar comparisons derived from the Murray and Flood report of 1922. (See ELECTRICAL WORLD, March 11, 1922, page 471.) The statistics contained in that report are on a slightly different basis, as apparently the kilowatt-hours generated were not published at that time. However, from the tables on pages 183 and 185 of that report (see table same issue, page 473) comparisons similar to those in column three in the foregoing table can be computed, and the ratios so calculated for the year 1919 are somewhat less than the 1922 ratios above.



Carnival Illumination Revived in New Orleans

THE most elaborate carnival illumination marked the Mardi Gras this year in New Orleans for the first time since the World War. Some 8,000 50-watt lamps in street streamers and 12,000 more in special decorations of stores, clubs and public buildings were installed. The popularity of this gala illumination gave fresh evidence of the fact that light never loses its attraction and that the great revival of sign and ornamental outline lighting that is now apparently in progress responds to a very fundamental appeal.



Pulverized-Fuel, Isolated-Phase Station—II

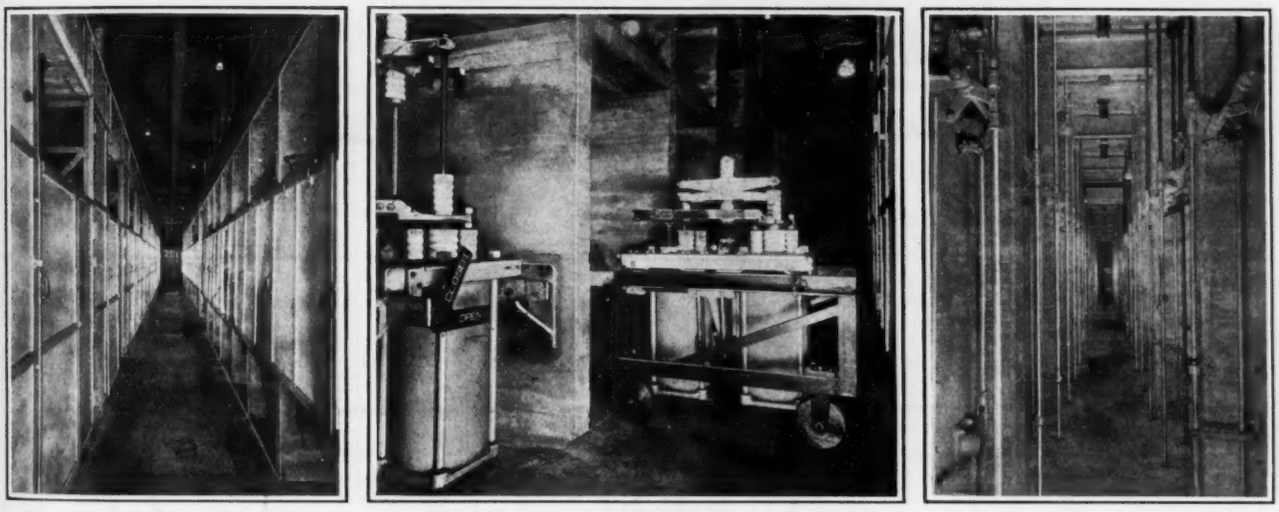
How Interruptions Will Be Avoided in Cahokia Station—Unit Layout with Isolated Phases, Switching Flexibility, Induction-Motor Drive for Auxiliaries, Duplication of Sources of Auxiliary Power, Sectionalization and Other Features

CONTINUITY of service, safety of operation and provision for extensions were the major requirements considered in designing the electrical features of the Cahokia station* of the Union Electric Light & Power Company of Illinois, just as they are in most of the large stations at the present time; but some of the methods employed in attaining the desired results depart in certain respects from general practice. These departures from or modifications of general practice will be particularly considered here, with the reasons back of them, but certain ideas incorporated in this plant which are not new to modern central stations will have to be included in the discussion to correlate the newer features.

Service continuity was attacked as a problem not only by selecting, arranging and installing equipment so that it would have an ample margin of reliability for performing its duty, but the design was so developed that possibilities of trouble would be remote and so that if trouble did occur it could be confined to a limited section and service still be maintained because of the flexible operating facilities provided. In addition, more convenient facilities for inspecting and repairing equipment were provided than usual. Virtually all of the steps taken to assure service continuity also increased the safety of the operating force, which is further protected by simple and uncomplicated means that experience has shown can guard human beings against their own or others' carelessness or thoughtlessness. Both reliability of service and safety of operation were sought at the minimum expense which would not jeopardize either reliability or safety. Although both were more important than cost alone, it will be noted in what follows that it was possible to effect economies in equipment cost, station construction, equipment installation, and even in operating-labor expense, despite the major requirements.

In general, continuity of service was sought by laying out the plant on the unit basis, isolating phases, minimizing the duty on equipment so that an ample margin of safety could be provided, affording flexibility of operation through duplication of sources of power for important uses, duplication of buses, sectionalization and use of reactors, interlocking operations that must be performed jointly, providing means of isolating trouble, and affording ready means of inspecting, testing, removing or replacing equipment and repairing it. The ways in which the main electrical connections and switching arrangements permit the foregoing will be discussed first. Later the physical layout and method of installing will be considered.

As may be observed from studying the accompanying one-line diagram of electrical connections, the designers of this plant provided duplicate main and auxiliary buses. The buses for supply of auxiliary motors† are

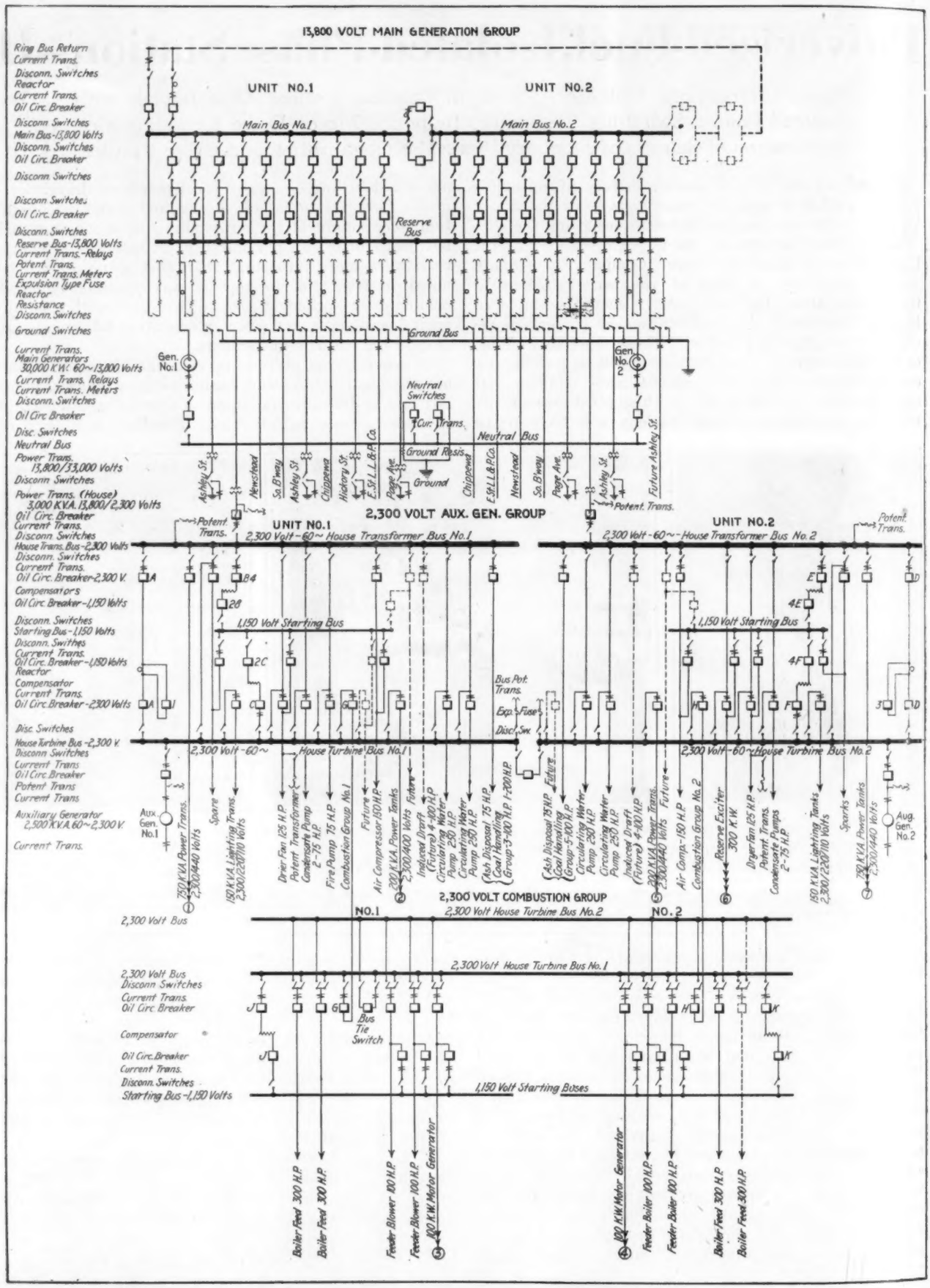


CIRCUIT BREAKER COMPARTMENT PANELS, INTERIOR OF COMPARTMENT AND OPERATING RODS

At left—Circuit breaker compartment gallery with closed doors mechanically locked by disconnect mechanism increase the safety of the operating force. Center—In the first section of this plant the circuit breakers which are mounted on rails attached to the compartment walls may be slid onto trucks and removed to repair chamber. Note semaphore on switch. Circuit breakers have jack-type terminals, and are vented to atmosphere. Next section will have circuit breakers permanently mounted on trucks. At right—Rods on back of circuit-breaker compartment connect units controlling same circuit on each floor. The rod connected to the bell crank operates the circuit breaker; the parallel rods operate disconnects. When the disconnects are closed the corresponding circuit breakers and compartment doors are locked in place.

*Factors affecting the location, initial size of plant and units and general design, how the highest economy was sought and what determined the selection of powdered coal and isolated phases were discussed in the March 29 issue of the ELECTRICAL WORLD, where there was also a discussion of the mechanical aspects of the plant.

†All auxiliaries are driven by induction motors except the pulverized-fuel feeders, which are each driven by a 15-hp. direct-current motor. Motors rated at 75 hp. or more are operated at 2,300 volts, and all rated at less than 75 hp. are operated at 440 volts. The 2,300-volt squirrel-cage motors have starting switches for connecting them to the starter bus, and slip-ring motors have drum controllers. The 440-volt squirrel-cage motors have individual starting compensation except those rated at less than 15 hp.



ONE-LINE DIAGRAM OF MAIN ELECTRICAL CONNECTIONS

(See opposite page for rest of diagram and for discussion of features.)

sectionalized so that the auxiliaries for each main unit are served from a separate section of each auxiliary bus. Besides this segregation of services, provision is made for throwing most 2,300-volt circuits on either one of two buses, and most buses are sectionalized and can be energized from either of two sources of power (in some cases more). Hence there is not much likelihood of more than a small portion of any service being interrupted from the supply, and then only until the feeder can be shifted onto another bus fed from another source of power, which is facilitated in the case of all-important service by the provision of bus-selector switches.

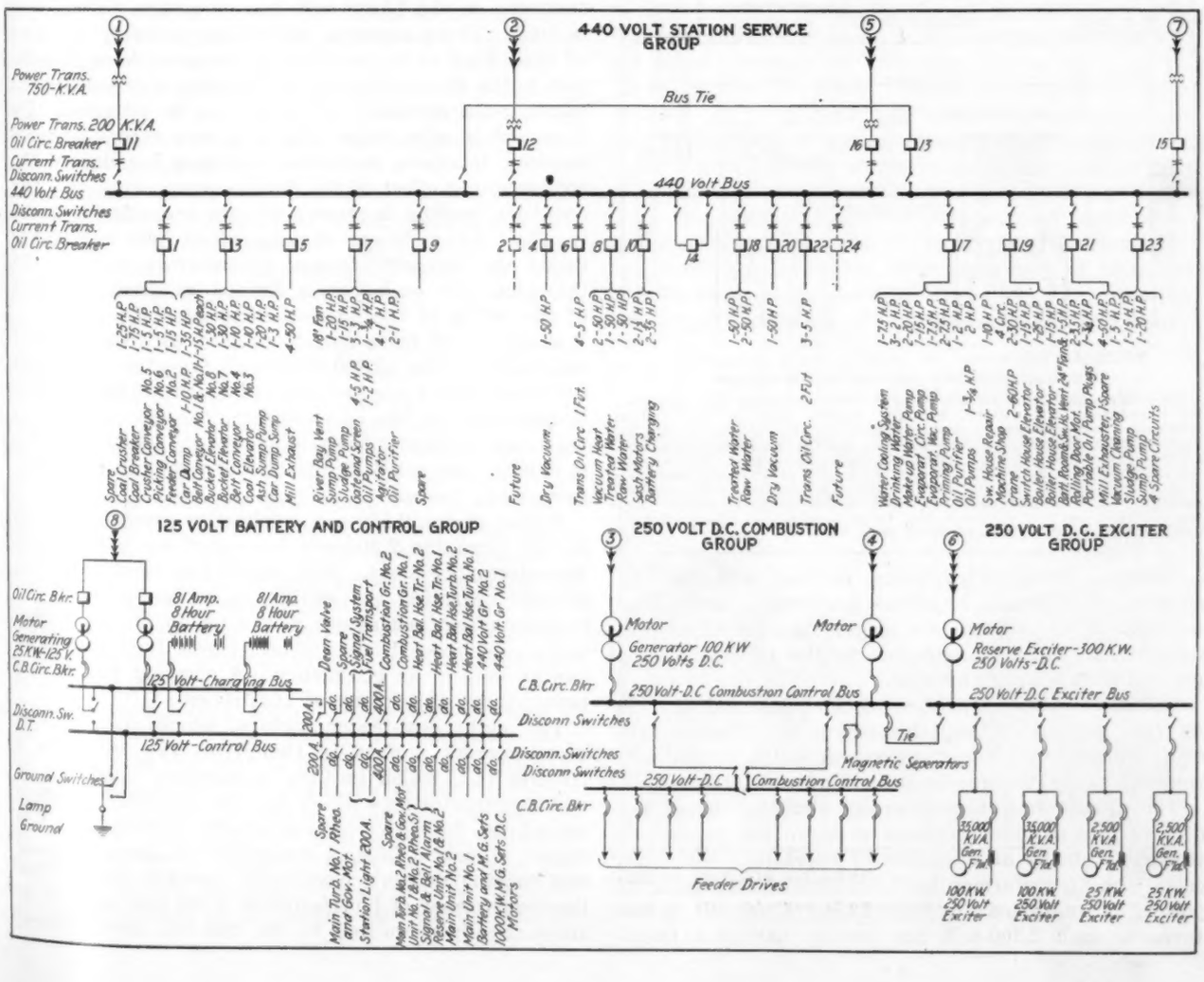
The foregoing provisions may seem involved, but the designers and operators considered that they were well justified by the greater continuity of service thus assured, especially since this plant will ultimately have a rating of at least 300,000 kw.

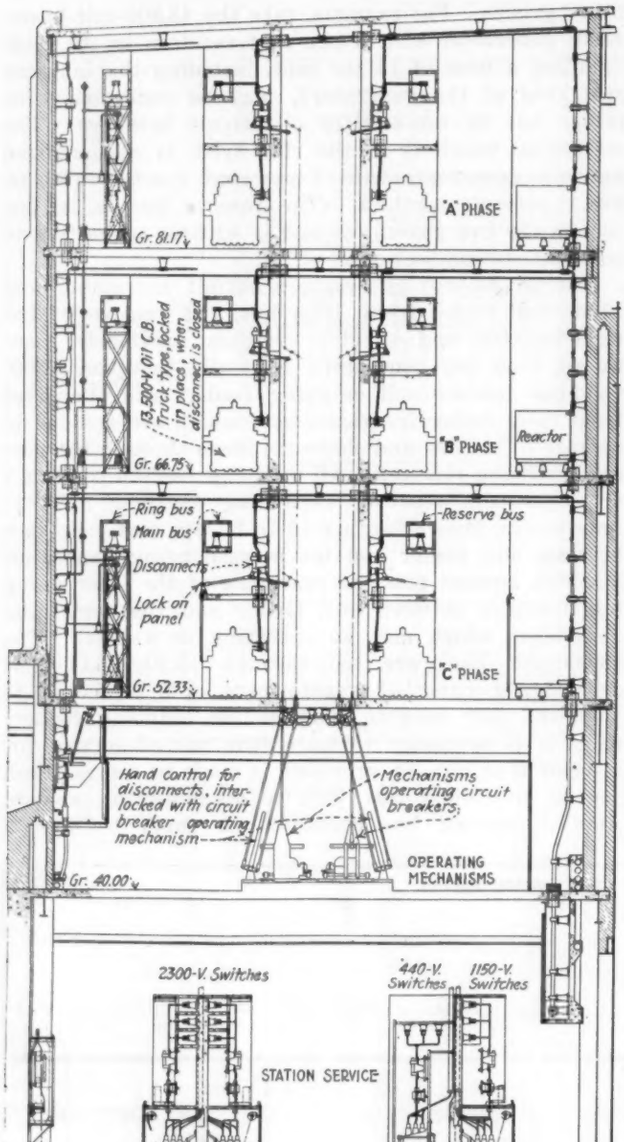
Methods of securing flexibility of operation and precautions taken to prevent disturbance on any one bus from spreading can best be understood by considering each group of buses and the corresponding switching arrangements individually and then with respect to the other groups. For example, take the 13,800-volt buses. Each generator, with 3 per cent reactors in its leads (making a total of 15 per cent, including the inherent reactance of the generator), may be connected with either bus by bus-selector oil circuit breakers. The main bus, which is of the ring type, is sectionalized between generators with 5 per cent reactors (35,300 kva.) between sections. The reserve bus is in one section for two generators and is without connection to adjacent station sections.

Selector oil circuit breakers permit energizing any 13,800-volt feeder from either bus, and, because of the sectionalizing and selector switches previously mentioned, from any generator. Normally, however, 2,300-volt bus feeders and outgoing feeders are energized from their respective generators, which are enabled to operate in parallel and share the loads through the bus-sectionalizing reactors. All outgoing feeders contain 3 or 4 per cent reactors, depending on their inherent impedances, thus affording 18 to 22 per cent reactance between any feeder and the corresponding generator, and this amount plus the reactance of the intervening bus reactors between any feeder and the remaining generators which may be operating in parellel. The 33,000-volt lines are fed through 13,800/33,000-volt delta-zigzag-connected transformers. For protection to men who may have to work on the outgoing feeders when it is necessary to take them out of service for inspection or repairs, provision is made to connect each one to a ground bus with a disconnecting switch. Another ground bus connected to earth through a

DISCUSSION OF ONE LINE DIAGRAM OF MAIN ELECTRICAL CONNECTIONS SHOWN ON THIS AND OPPOSITE PAGE

Among the features are segregation of services, provision for operating on unit basis normally, flexibility of feed in emergencies, duplication of buses and sources of power, sectionalization and use of reactors. Aside from the selector switches and generator, bus-tie and feeder reactors in 13,800-volt system, note particularly the method of feeding auxiliaries from house turbo-generators or from the main generators through transformers, and the saturated-core reactors between the 2,300-volt buses. Also segregation of major and minor auxiliaries and precautions taken to assure reliability of 250-volt coal-feeder power supply and 125-volt control and emergency lighting.





VERTICAL ISOLATION OF PHASES WITH OPERATING MECHANISMS AND CONTROL ROOM BELOW

This arrangement permitted a narrow foundation (necessitated by foundation difficulties), brought weight close to foundation, minimized superstructure cost, reduced length of control wiring and brought control rooms in close proximity to operating floors. Switch mechanism is not exposed to fumes or flames from equipment troubles. Simplicity of arrangement minimized construction and installation problems, facilitates inspection and test, and affords less cramped quarters than when grouped phases are used. Each section of each bus is in a separate chamber that can be ventilated by forced-draft fan.

1,300-amp. (two-minute), 6-ohm resistor, which will be shunted automatically by circuit breakers if the resistor is required to carry current longer than its rating will permit, may be also connected to the neutral of any generator by a circuit breaker.

Differential relays protect against internal trouble in the generators and transformers. Feeders are equipped with sheath-current transformers, ground-current relays and inverse-time limit overload relays.

The 2,300-volt generator-group auxiliary buses are divided into as many sections as there are generators to carry out the unit scheme of operation. One bus, called the "transformer bus" because of its source of power, is energized through 13,800/2,300-volt transformers, each 2,300-volt bus section having a transformer energized from the corresponding section of the 13,800-volt bus. Here again duplicate sources of power are afforded by the bus-selector oil circuit breakers on the 13,800-volt side of the transformer. A second 2,300-volt bus, called the "house-turbine bus," is energized by two house turbo-generators, one attached to each section of the first two bus sections and also tied to the "transformer bus" by saturated-core reactors, one between each section. To this bus are connected all auxiliaries whose continuous operation is essential to operate a main unit. The auxiliaries, shutdown of which would not be serious if something happened on the 13,800-volt system, are connected to the transformer bus only. The more important auxiliaries—those on which continuity of operation and safety of the plant depend—may be connected to either transformer bus or house turbine bus by selector switches, although they are normally operated on the house-turbine bus. To afford a source of 1,150-volt power for starting the 2,300-volt auxiliaries a starting bus is provided which may be energized from any section of either 2,300-volt bus through compensators.

SATURATED-CORE REACTOR TIES TRANSFORMERS AND HOUSE-TURBINE BUSES

The purpose of the saturated-core reactors between the 2,300-volt transformer and house-turbine buses is to enable adjusting the load on the house turbo-generators to maintain heat balance by allowing a limited exchange of power between the two buses without creating any service embarrassment if there is a disturbance on the 13,800-volt bus or system to which it is tied. These reactors, which are probably the first of their kind to be used for the purpose, have in addition to the alternating-current winding a direct-current winding the excitation of which can be adjusted. Up to a certain adjustable value of power exchange, these reactors interpose moderate reactance because of the compensating effect of the direct-current winding. Any condition tending to cause a greater exchange of power is offset by a strong choking effect which virtually limits the exchange to any predetermined value. In this plant the exchange is limited to about one-third of the rating of the house-turbine generators.

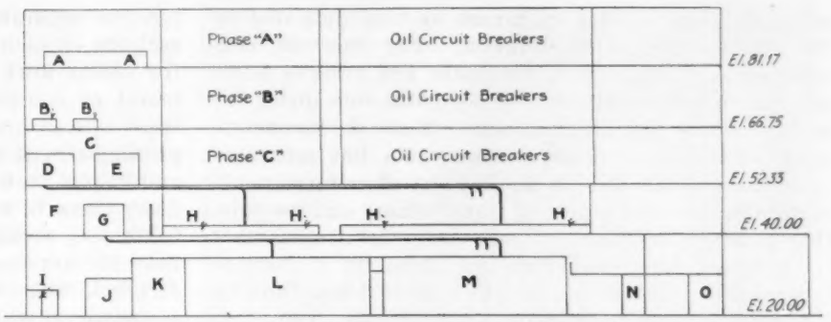
Reactance of these devices coupled with the inherent reactance of the 13,800/2,300-volt transformers limits the power which can be delivered by the 13,800-volt bus to the 2,300-volt bus on short circuits. Feed-back from the house turbine 2,300-volt bus to the 13,800-volt bus is further prevented by directional relays in the transformer-bus feeder.

Either of the 2,300-volt combustion-group buses can be fed from the 2,300-volt house-turbine bus through bus-selector switches. Here again bus sectionalization permits operating the auxiliaries on power from the corresponding generators according to the unit plan and also enables them to obtain power from any other bus or unit in an emergency. A starting bus is also provided for this group of auxiliaries.

The eight coal-feeder motors, which are the only direct-current motors in the plant, are fed from a 250-volt bus, which in turn is normally energized by motor-generator sets which may be connected to either one of the 2,300-volt combustion-group buses. If this source of power fails, a duplex-driven exciter (motor and turbine driven), electrically operable from either the transformer or house-turbine 2,300-volt bus, will be automatically connected to the 250-volt direct-current

buses. Automatic connection of the reserve exciter to the generator field in case of interruption of normal excitation has not been adopted, because it is believed that if excitation was interrupted the unit would lose its load before the reserve exciter could come into play.

The two 440-volt station-service buses, providing power for all motors below 75 hp., are each divided into two sections, each energized by 2,300/400-volt transformers, each connected with a different section of the 2,300-volt generator-group buses. The two end sections serving the minor 440-volt auxiliaries are energized from separate sections of the transformer bus, although they may be connected by bus ties if desirable. The other two sections of the 440-volt bus which serve the major 440-volt auxiliaries are energized from separate sections of the house-turbine bus, although the buses may be tied together and operated from either section of the house-turbine bus.



DIAGRAMMATIC CROSS-SECTION OF BUS AND SWITCHING STRUCTURES OF THE CAHOKIA STATION

The phase chambers for each main unit are separated by concrete walls and intervening floors; the circuit breaker and disconnect switch mechanisms are on a floor below the lowest phase floor; the switchboard control rooms for 13,800-volt equipment and auxiliary circuits are close to the main operating floors of the station, which are at grades +40 and +20; the auxiliary circuit breakers are on the lowest operating floor convenient to the auxiliaries.

A—Storage batteries.
B—Motor generator.
C—Main generator and feeder control room.
D—Feeder board.
E—Generator board.
F—Watch supervisors' room.
H—Oil circuit breaker mechanisms.
I—Generator neutral ground resistor.
J—Compensators.
K—Reactors.
L—2,300-volt station service.
M—Oil circuit breaker structure.
N—Compensators.
O—Reactors.

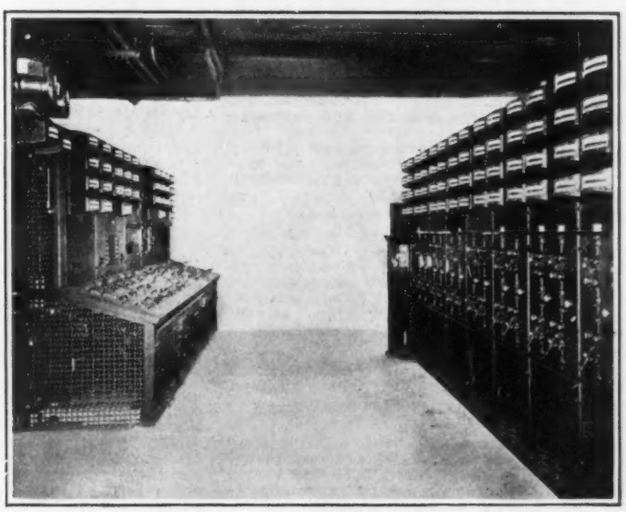
Power supply for the control circuits and emergency lighting is assured by two motor-generators and two storage batteries, the motor-generators being operated from that section of the 440-volt bus which is energized by the house-turbine bus. Normally, one motor-generator set and one battery are connected with the operating bus and the other battery and motor-generator set are always kept in readiness for use. The duplicate bus permits charging one battery while the other is floating on the operating bus without subjecting the control apparatus to the voltage adjustments required in battery charging.

Since house turbines will not be required in additions to the Cahokia plant, the furnishing of auxiliary service will be slightly different. The principal changes will be operation of all auxiliaries from the house transformer buses and use of the house turbines for emergency starting only.

From the viewpoint of the physical layout of the equipment, the phase isolation of the 13,800-volt circuits and equipment is striking. As pointed out in the previous article, this was chosen because it reduced the possibility of phase-to-phase short circuits and consequently reduced the duty imposed on oil circuit breakers. Vertical-phase isolation was chosen chiefly because it minimized foundation costs—a major consideration, as explained in the previous article—but also because it was found less expensive than horizontal isolation and no more expensive than grouped phases. The cubical content of the electrical gallery as well as the amount of concrete work required was found to be less than for grouped phases.

As may be noted by observing the cross-sections of the switch house, the A phase is on the upper floor, the B phase on the next, C phase on the next and the circuit-breaker and "disconnect" operating mechanism below the C phase. The lowest phase floor has also the main control room, and the station service switching equipment is at the mechanism and main turbine-floor level. With this general arrangement of electrical equipment the bulk of the weight was brought near the foundation, thereby reducing the superstructure expense, minimizing the length of control wiring and bringing the control room in close proximity to the operating force of the plant. Furthermore, by placing the operating mechanisms below the switches the mechanism room will not be exposed to the fumes or flames which would arise from switching equipment trouble and they are more accessible for hand operation in emergencies. Among other advantages of the electrical arrangements which have been demonstrated during plant construction and operation up to date, the following might be cited: Ability to carry on electrical construction as the building erection progresses, ease of installing copper due to straight runs, possibility of making taps without offsets, small amount of jointing and drilling required, possibility of separating potheads more than with group-phase arrangement, ease of installing jumpers for test or emergency operation without proximity of another phase lead, ease of installing ground buses and taps, facilities for safe inspection, simpler arrangements and connections, and less cramped quarters for equipment than where the grouped-phase arrangement is used.

Phase isolation also permits practically as simple a



BENCHBOARD AND OPERATING PANELS

physical layout of the equipment as that indicated by the schematic one-line diagram. For example, considering any phase floor, the main and reserve buses are run in horizontal concrete compartments under the ceiling of two parallel chambers separated by concrete walls. Parallel to these compartments but separated from them by an aisle is another set of compartments containing a row of potential transformers and reactors. One primary terminal of each potential transformer is connected to a riser from the A to the C floor to form the star connection and to a ground bus running along the back of the C floor compartments. The other transformer terminal is connected with its respective phase circuit at the reactor. In compartments below the bus are the circuit breaker disconnect switches. Below these in separate compartments are the respective oil circuit breakers. One of each pair of disconnecting switches is connected with the bus above and the other is joined to the incoming or outgoing circuit reactor (or circuit where there is no reactor) in line with it. The lower sides of the "disconnect" join jack-type terminals on the corresponding circuit breakers below. This layout is repeated for each bus section and each phase floor, only one phase bus section and the corresponding oil circuit breakers being in each chamber.

The foregoing arrangement of chambers and compartments not only isolates each group of apparatus from other groups, but also separates the individual piece of apparatus in case of disturbance. Between bus sections on each floor is an open space which is utilized for repair work and inspection which requires the removal of equipment from its operating position. In these spaces are small chain blocks suitable for suspending circuit breakers while their oil pots are lowered and inspection or repairs made. In addition, on the top floor, there is suspended overhead at one side a tank containing fresh oil for switch pots with taps on each floor for drawing off the oil. Sinks with a drain to a dirty-oil tank in the basement facilitate the disposal of switch oil which must be purified. Below the switch oil tank on the top phase floor is a motor-driven forced-draft fan connected to a system of ducts that lead to the circuit-breaker chambers on each floor of the switch house. Dampers in these ducts permit withdrawing air from all chambers or concentrating on any one in case it is desirable.

By placing the repair section on each floor in a vertical line it was possible to provide open gratings in the floors to allow natural ventilation of the switch and reactor chambers without introducing the hazard often associated with air wells in switch houses. This hazard is eliminated because the air well extends only through the repair section and because the switch and reactor chambers can be closed with fire doors and forced ventilation employed.

In addition to these precautions for removing fumes,

Ratings of Some Important Electrical Equipment at Cahokia Station

MAIN AND HOUSE TURBINE GENERATORS

Main Units:

35,300-kva., 13,800-volt, 3-phase, 60-cycle 0.85 P.F., 1,800-r.p.m., one General Electric and one Westinghouse; ventilating air requirements—80,000 c.f.m. and 84,000 c.f.m. respectively at 104 deg. F.; air-cooling system—closed-circuit system with Griscom-Russell surface-air coolers; fire-suppression system—receivers of CO_2 gas at 200 lb. pressure discharging into ventilating system, and water coils in end bells of generators; exciters—150-kva., 250-volt shaft-driven; also one 300-kw., 250-volt reserve duplex-driven exciter.

House Turbine Generators:

2,500-kva., 2,300-volt, three-phase, sixty-cycle, 0.80 P.F., 3,600-r.p.m. Westinghouse; ventilating air—8,000 c.f.m. at 104 deg. F.

CIRCUIT BREAKERS AND DISCONNECTING SWITCHES

13,800-Volt Breakers:

Generator and bus tie—six 2,000-amp.; generator neutral—four 1,200-amp.; feeder bus selectors—thirty-four 800-amp.; all General Electric type FHD-17 single-pole; rupturing capacity, 38,000 amp. at 13,800 volts.

2,300-Volt Auxiliary Power Breakers:

Generator transformers and bus tie—five 1,200-amp.; feeders, bus ties and primaries for 440-volt transformers—thirteen 600-amp.; feeders, compensators and 440-volt primaries—thirty-five 300-amp.; all type B2 Westinghouse; rupturing capacity, 16,000 amp. at 2,500 volts.

440-Volt Auxiliary Power Breakers:

Feeders, transformers and transformer-bus ties—fifteen 300-amp.; feeders and transformer bus ties—four 500-amp.; 300-amp. and 500-amp. type F2 Westinghouse and 1,200-amp. type B2 Westinghouse; rupturing capacity, 20,000 amp. at 440 volts.

Neutral Grounding:

Two 1,200-amp. single-pole, single-throw 15,000-volt (one automatic, one non-automatic) type FHD17 General Electric.

Disconnecting Switches:

13,800-volt single-pole, single-throw General Electric, 2,300-volt and 440-volt single-throw, hook-stick-operated, Electric Power Equipment Company; neutral grounding—two type LG-116 General Electric.

TRANSFORMERS

Step-up Tie:

Three three-phase delta-zigzag-connected 12,000-kva., 13,800/33,000-volt forced oil-cooled, General Electric.

Step-up Feeders:

Three three-phase delta-zigzag-connected 7,500 kva., 13,800/33,000-volt force-cooled General Electric.

Station Power:

Two 3,000-kva., 13,800/2,300-volt self-cooled and water-cooled General Electric; two 750-kva., 2 300/440-volt self-cooled Westinghouse; two 200-kva., 2,300/440-volt self-cooled Westinghouse; all three-phase delta-delta connected.

Station Lighting:

Two single-phase, 150-kva., 2.300/230-115-volt self-cooled Westinghouse.

REACTORS

Generators—three 3 per cent General Electric single-phase, concrete-clad; main bus ties—three 5 per cent General Electric; feeders—twenty-four 3 and 4 per cent Metropolitan; 2,300-volt interbus ties—220-kva. saturated core type General Electric.

MOTOR-GENERATORS

Direct-Current Power:

Two 100-kw., 250-volt compound-wound Westinghouse generators driven by 150-hp., 2,300-volt motors; battery charging—two 25-kw., 125-175 volt shunt-wound Westinghouse generators driven by 35-hp., 440-volt motors.

SOME AUXILIARY DRIVES

All motors in the Cahokia plant of 150 hp. and under are Wagner, except the direct-current full-feeder motors, which are Westinghouse; all motors of more than 150 hp. are General Electric.

(All 75 hp. and over, 2,300-volt. All under 75 hp., 440-volt)

Driers—two 125-hp. Wagner induction motors; pulverizers—eight 100-hp. Wagner squirrel-cage; coal feeders—eight 15-hp. Westinghouse adjustable-speed 250-volt direct-current; primary air fans—four 100-hp., 1,200-r.p.m. Wagner squirrel-cage; ash handling—75-hp. Wagner squirrel-cage; boiler-feed pumps—three 300-hp. 1,800-r.p.m. General Electric slip-ring; circulating pumps—four 250-hp., 400-r.p.m. General Electric slip-ring; condensate pumps—four 75-hp. Wagner slip-ring; air pumps—two 50-hp., 600-r.p.m. Wagner slip-ring; intake screens—four 5-hp., 1,200-r.p.m. squirrel-cage; raw-water pumps—five 50-hp., 1,200-r.p.m. Wagner squirrel-cage; make-up pumps—two 20-hp., 1,200-r.p.m. Wagner squirrel-cage; dredge pump (ashes)—two 75-hp., 1,200-r.p.m. squirrel-cage; air compressor—two 150-hp., 720-r.p.m. Wagner squirrel-cage; sludge pumps—two 15-hp., 1,800-r.p.m. Wagner squirrel-cage; sump pump—three 20-hp., 1,200-r.p.m. Wagner squirrel-cage; fire pump—one 75-hp. Wagner squirrel-cage.

MISCELLANEOUS

Oil Purifiers:

Two 600-gal.-per-hour De Laval centrifugal purifiers; batch system for prime movers, continuous system for transformers.

Transformer Oil Coolers:

Seven multiwhirl Whitlock oil coolers.

Elevators:

Electrical bay, passenger and freight, 2,500 lb. at 75 ft. per minute, full-automatic dual control; boiler house, passenger and freight, 2,500 lb. at 150-ft. per minute full-automatic with micro-leveling dual control; coal tower, passenger, 1,000 lb. at 137 ft. per minute full-automatic dual control; all Otis.

Turbine-Room Crane:

One Niles-Bement-Pond 440-volt alternating-current, with 110-ton main hoist and 10-ton auxiliary hoist.

Instrument Transformers:

Current-type, single-turn primary, single-coil secondary General Electric; potential-type, oil-insulated General Electric with S. & C. fuses and current-limiting resistors.

Switchboards:

Main generator and tie feeder benchboard, five panels General Electric; main feeder control, six-panel General Electric; generator-group auxiliaries, Westinghouse; direct-current power and battery, Electric Power Equipment Company; lighting panels, Electric Power Equipment Company.

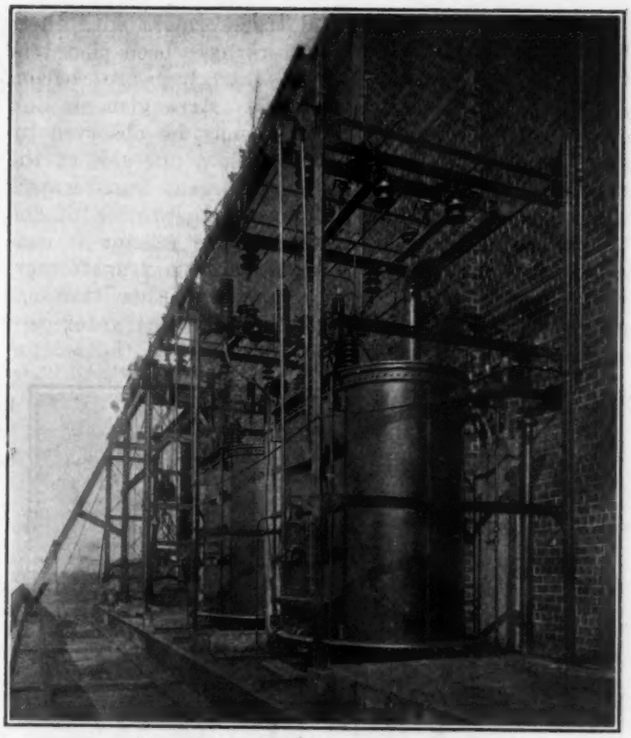
Storage Battery:

Two 81-amp. for eight hours (360 amp. for one hour) sixty-three-cell type F-19 126-volt, Electric Storage Battery Company.

gases and heat, each circuit-breaker oil pot is connected with a vent to atmosphere, using the railings which guard the switch-operating rods along the backs of the compartments as manifolds.

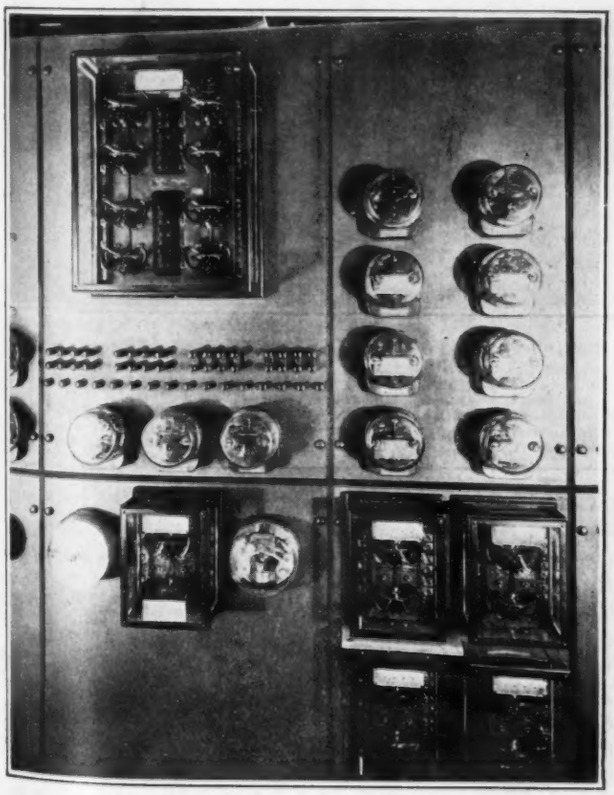
The circuit breakers which are mounted on rails attached to the compartment walls may be removed when in open position for replacement, inspection or repair by loosening a wing nut which holds them in place and sliding them onto a portable truck on which they can be transported to the repair room previously mentioned. Removal of a circuit breaker while the corresponding "disconnects" are closed is prevented by a mechanical interlock. The same interlock prevents opening the cell doors in front of the circuit breakers and "disconnects." As an additional precaution "open-and-closed" semaphores are mounted on the circuit breakers. All disconnect switches on any circuit are operated by a common mechanism whose operating handle is adjacent to the motor-operating mechanisms of the oil circuit breakers. Disconnect switch mechanisms are so interlocked with oil switch mechanisms that the former will not operate unless the later are open.

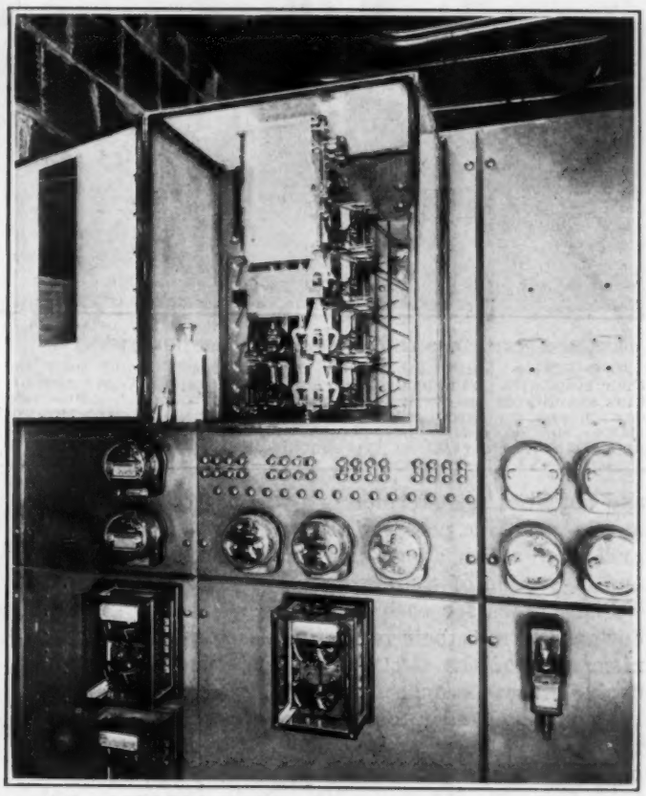
Remote operation of the circuit breakers as well as the "disconnects" is afforded by vertical rods which run down the back outside wall of each compartment to the operating-mechanism floor, the A, B, and C phase circuit breakers and corresponding "disconnects" being gang-operated and mechanically interlocked so that a "disconnect" can never be opened after the circuit breaker is closed. The weights of the vertical rods are counterbalanced. If any adjustments are required in the switch rods, such as for changing switch travel, they may be made by means of turnbuckles while the circuit controlled is "alive." Motor-operated mechanisms actuate the circuit breakers normally, although they may be opened or closed by hand.



TWO THREE-PHASE 13,800/33,000-VOLT TRANSFORMERS FEEDING SUBMARINE CABLES

These transformers and others which will be added to supply submarine cables are situated in a bay on the river side of the station. The 13,800-volt circuits are brought up to the level of the transformer terminals through single-conductor cable on the river wall of the station. The 33,000-volt terminals are connected with the single-conductor cable potheads on the racks over transformers. In the basement these single-conductor cables are connected with the three-conductor submarine cables with crotch joints and "get-away" obtained through wells extending to the river bed. Note forced oil-cooling piping and provision for removing transformers on trucks.



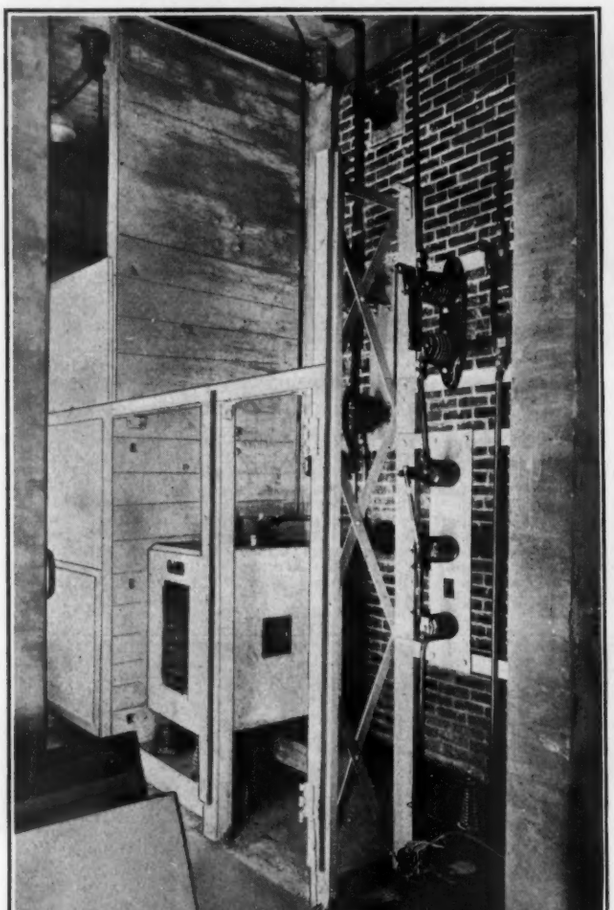


TOTALIZING WATT-HOUR METER AND GRAPHIC WATTMETER
At left—Watt-hour meter on relay and meter panel. At right—Graphic wattmeter

The reactors and potential transformers with their "disconnects," fuses and resistors have been placed in the same compartment in cases where both are used on any incoming or outgoing circuit. Arrangements and connections are very simple, as may be observed by studying the illustration shown below, one side of the reactor being connected through current transformers with the corresponding disconnecting switches of the bus selectors. The other side of the reactor is connected with the phase side of the potential transformer, which, as mentioned before, has the other terminal grounded so that all potential transformers for any circuit are connected in star. In front of the reactor and potential transformer is a hinged solid-panel door, and between the potential transformer and reactor is a grill door which allows the ventilation of the reactor and inspection of the apparatus in the compartment.

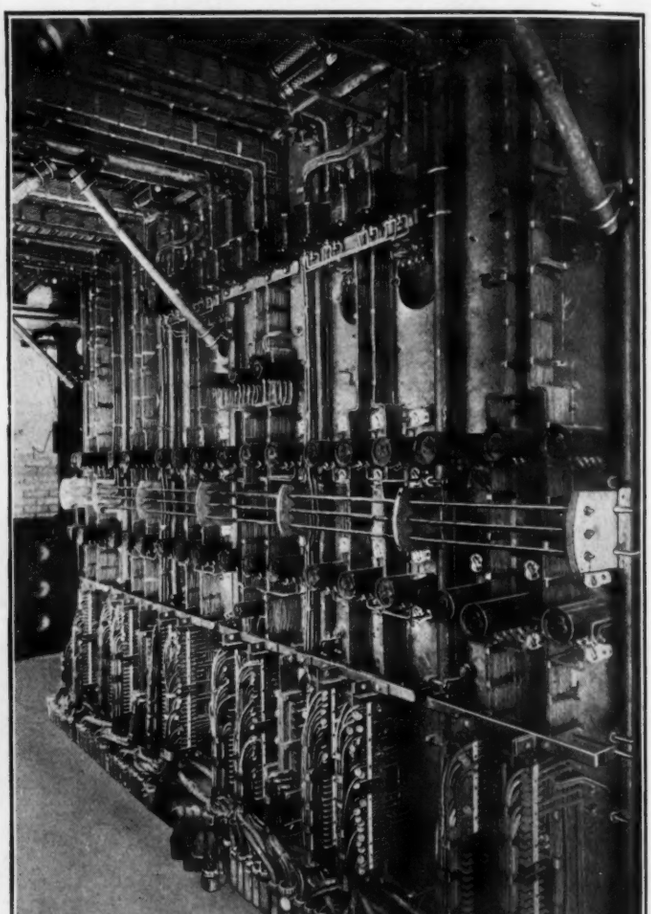
Phase leads for each outgoing circuit run vertically downward from their respective reactors to the mechanism floor of the electrical gallery, where single-pole, double-throw disconnecting switches permit connecting the outgoing feeder to them or to a ground bus when the cable is being worked upon. Circuits the voltage of which must be increased before leaving the station run from this location in single-conductor cables through concrete ducts in the outside river wall of the station to potheads opposite the terminals of their respective transformers. This arrangement, as well as the mounting of the step-up transformers, the arrangement of the high-tension buses and the means of connecting them with the submarine cables crossing the Mississippi River, is shown in the illustration on page 665. As may be seen, the high-tension terminals of these transformers run to buses above, attached to suspension insulators, and thence through air-break disconnecting switches to single-conductor potheads supported on the bus structure.

From these points the circuits continue in single-conductor cable below the roof of the river bay, where they are connected by crotch joints with three-conductor submarine cables which are led away from the building through wells, one at each end of Section 1, running down to the bed of the river. These cables are insulated for an operating pressure of 33,000 volts and have three conductors each with a cross-section of 350,000 circ.mils. Over the lead sheath of the cable are a layer of jute, one of steel-wire armoring and another of jute. The cables were in such lengths that only one joint had to be made in the river crossing (2,500 ft.). The submarine cables, of which there are twelve at the present time, were laid three at a time by scows carrying six reels. At the middle of the river the joints in the cable were made on the scows, lowered into the river and the cable terminated on the St. Louis side.



REACTOR AND POTENTIAL TRANSFORMER COMPARTMENT

Left—These units are placed opposite their respective phase bus-selector switches, thus simplifying bus-work and arrangement of equipment compared with grouped phases. Feeder side of reactor and one side of potential transformer joined through disconnect, liquid fuse and current-limiting resistor. Other side of potential transformer grounded. Bus side of reactor runs through two current transformers to bus-selector disconnects. Solid-panel doors cover front of reactor and potential transformer compartments and a grill door between compartments permits ventilation and inspection.



BACK OF AUXILIARY CONTROL BOARD

Right—Note terminal blocks and identifying tags and racking of control wiring to avoid obstruction of backs of panels.

Installation and Testing of 66-Kv. Cable

Two Subway Circuits Laid by Cleveland Company Extend 8¼ Miles Across City—Detailed Description of Conductors and Method of Laying—New Joint Proves Very Satisfactory

TESTS of the 66,000-volt single-conductor cable circuit constructed by the Cleveland Electric Illuminating company across the city of Cleveland, a distance of 8¼ miles, have, as recently announced in the news columns of the ELECTRICAL WORLD, been entirely successful.

This cable, which, as already stated, is the highest-voltage cable as yet constructed in America for underground transmission, connects the company's power plant at East Seventieth Street and Lake Erie with the company's overhead high-tension transmission line beginning at the city limits. The overhead line continues 12½ miles to the Cuyahoga-Summit County border, where it ties in with the system of the Northern Ohio Traction & Light Company. This system in turn ties in with the system of the Ohio Power Company, making a complete connection between Lake Erie and the Ohio River.

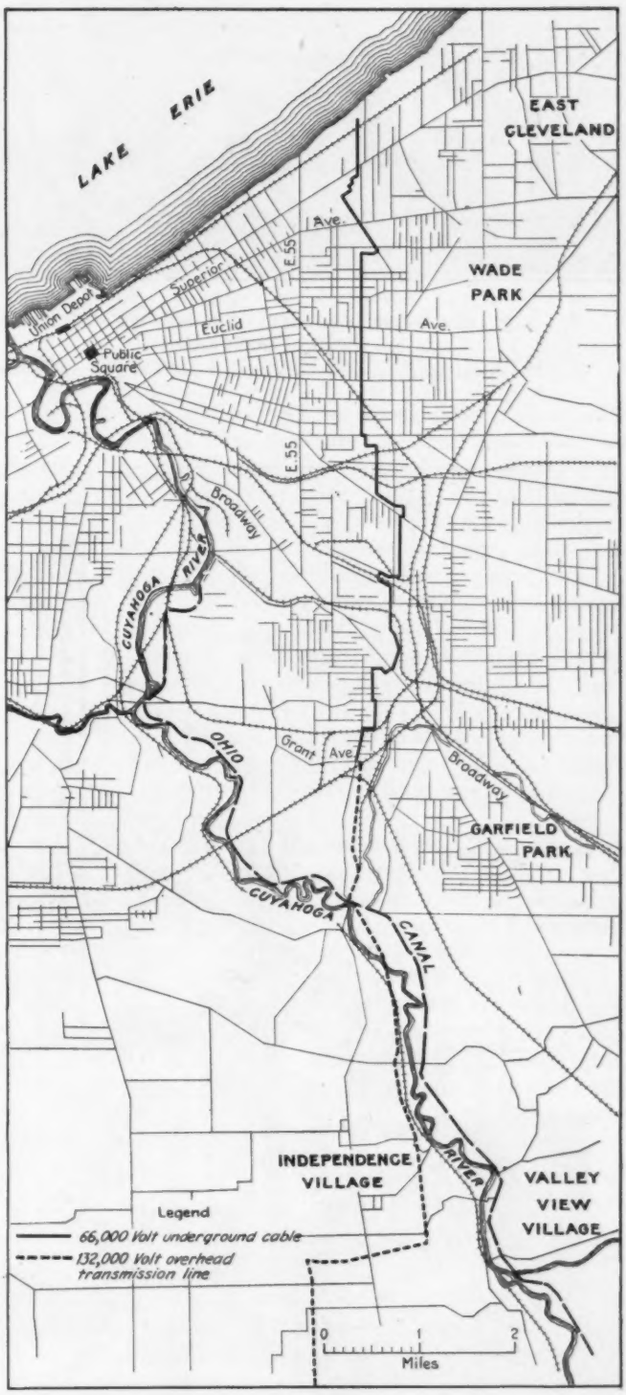
The 66,000-volt cable has been tested with 152,000 volts direct current, a pressure greatly in excess of what it will be required to carry in regular service, and it has withstood this test perfectly. The development of the cable grew out of the necessity for transmitting current at high voltage across the city to supply the southerly part of Greater Cleveland and to connect with the system of the Northern Ohio Traction & Light Company, which serves Akron and adjacent territory.

The Lake Shore station is so situated, with the lake on one side and closely built-up city streets extending for miles in every other direction, that it is practically impossible to take out any appreciable part of the energy produced there through overhead transmission lines. The number of wires required, or spacing between wires if extremely high voltages were used, would be so great as to preclude carrying them in or across streets and alleys in the usual way.

Underground cables had to be relied upon, and with the increasing size of the station and consequent increasing number of outgoing circuits, the problem of finding sufficient space in the streets even for underground cable ducts was troublesome. These considerations led to a decision to use 66-kv. single-conductor cables. Furthermore, the percentage loss in voltage and power due to the resistance of the cable is less as the voltage is increased.

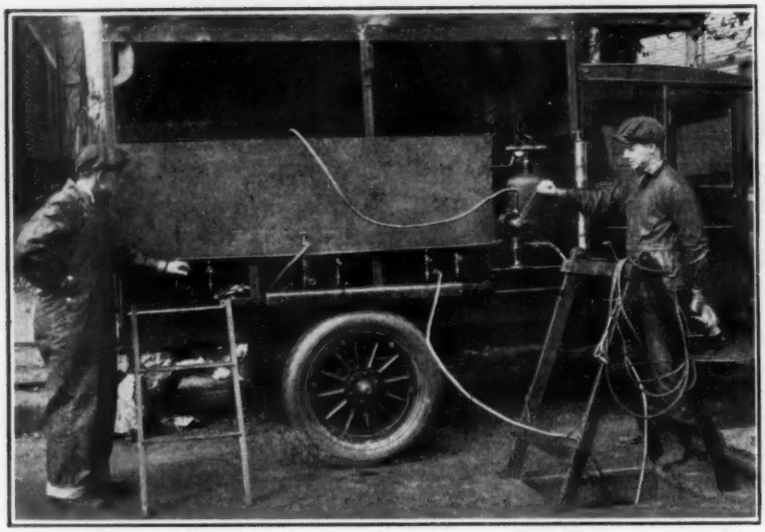
For any voltage higher than 11,500, at which energy is supplied from the Lake Shore station generators, step-up transformers are necessary, and these transformers introduce some losses on their own account. These losses are independent of the ratio of transformation, and, therefore, when it is once decided to use transformers, it is best to step the voltage up to the highest value consistent with present cable design. The company's engineers decided that cable for safe operation at 66,000 volts could be obtained, despite the fact that no cable approaching this voltage had heretofore been manufactured in this country.

This 8¼-mile subway holds two three-phase circuits.

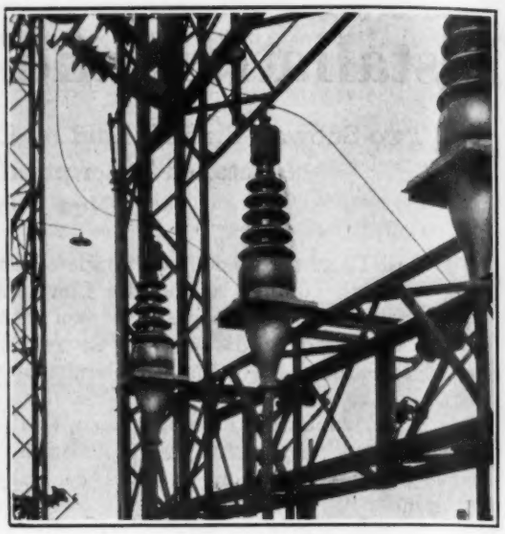


ROUTE OF 66-KV. CABLE ACROSS CLEVELAND

The diameter of the copper conductor is a little less than 1 in. (cross-section of copper is 500,000 circ.mil); the thickness of the paper insulation is 13/32 in. and that of the lead sheath 3/4 in., making the over-all outer diameter just about 3 in. For the two circuits approxi-

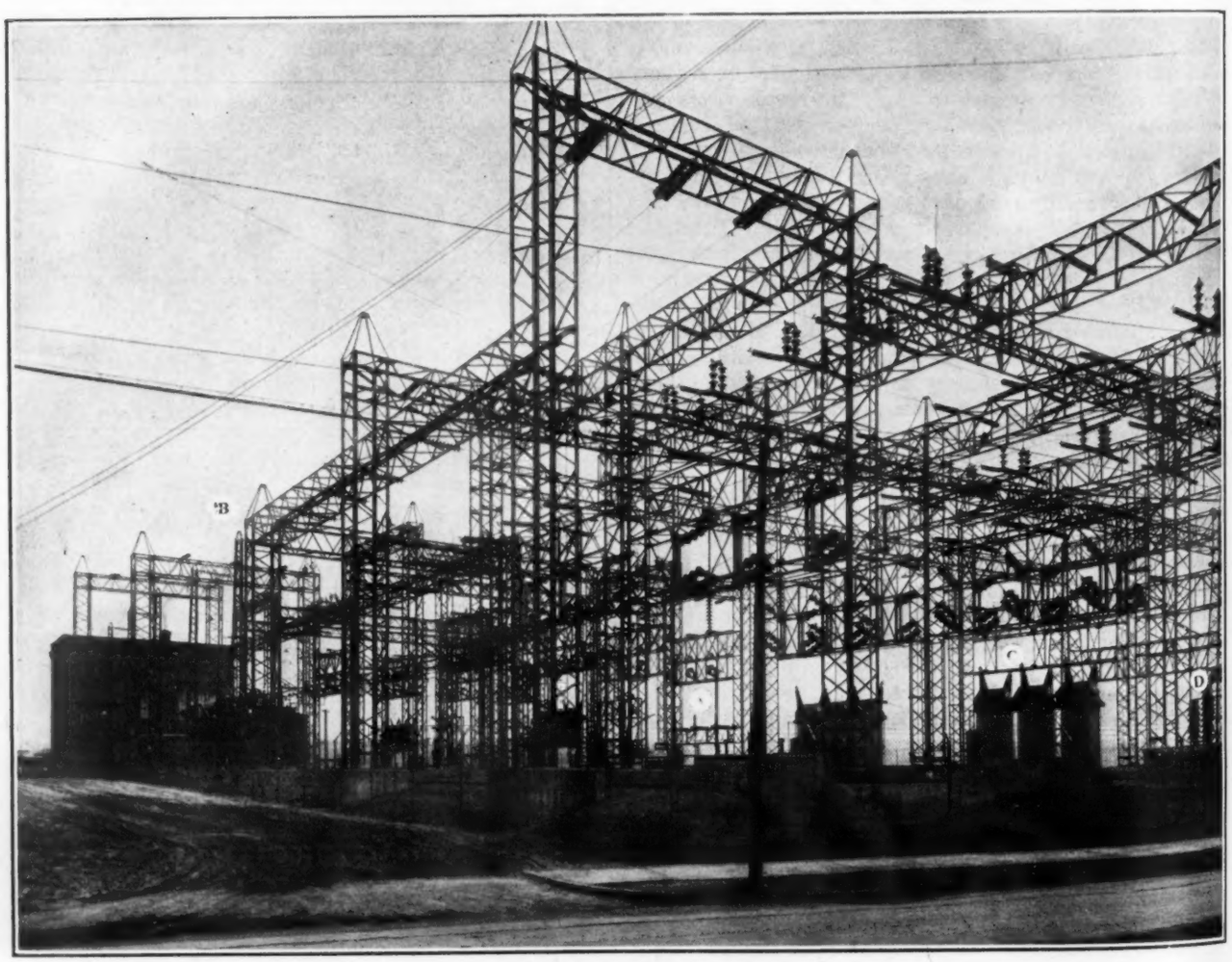


APPARATUS USED FOR FILLING JOINTS ON NEW 66-KV. UNDERGROUND CABLE



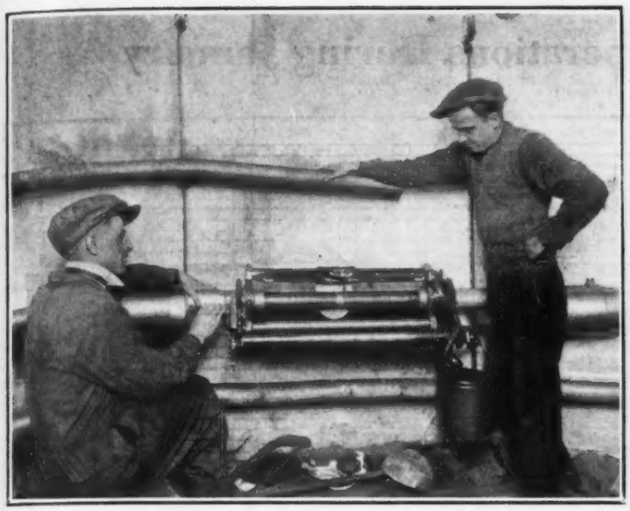
CABLE TERMINAL BUSHINGS AND GANG-OPERATED SWITCHES

Fireproofing covers cables from ground to bushing and sheath grounds are provided, as shown at the right

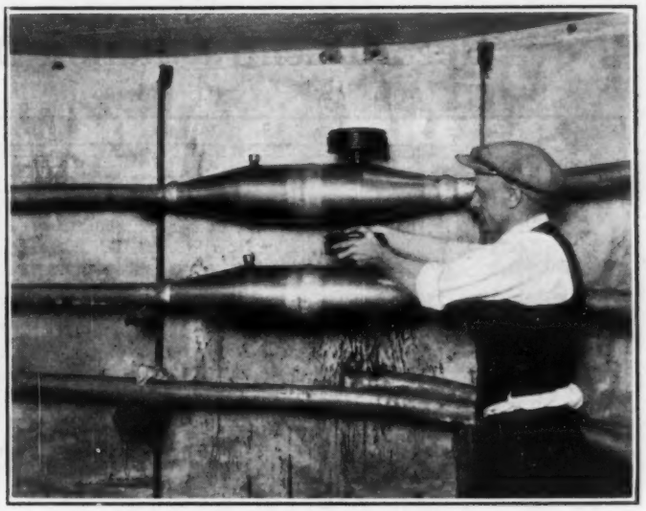


AT OAK STREET THE 66-KV. CABLE EMERGES AND ENERGY IS STEPPED UP TO 132,000 VOLTS FOR OVERHEAD TRANSMISSION

Cable emerges at *A* to high-tension bushings and goes to overhead main or transfer bus through 66-kv. switches to transformers with tertiary windings which step up the energy to 132 kv. on bus *B*. High-tension line leaves at right foreground. *C*, through 132-kv. breakers and on steel towers. Lightning protection is by oxide-film arresters, *D*.



MAKING 66-KV. JOINTS IN A MANHOLE



COMPLETED 66-KV. JOINTS IN A MANHOLE

A special taping machine (shown at left) is used which needs only 6-in. clearance. The joint is about 2 ft. in length.

mately 50 miles of cable was required. Because no one cable manufacturer would undertake to furnish so large a quantity within the period that was required, the order was necessarily divided between several cable manufacturers.

The first construction work to be started was the installation of the underground subway, consisting of six 4-in. inside-diameter fiber conduits—three high and two wide—incased in a shell of concrete, the top of which is at least 4½ ft. below the paving. The fiber was assembled on concrete spacers and poured as a unit structure.

At intervals of about every 300 ft. along the subway manholes had to be constructed in which the joints connecting one length of cable to the next could be made and housed. Upon approaching the manholes the ducts are fanned out gradually, giving an appreciable increase in duct outlet separation. The manholes are of concrete construction, 7 ft. long, 5 ft. wide and not less than 9 ft. deep, made from standard collapsible forms. The cable sheath is grounded at each terminal and at each manhole. Power-driven machinery was used to a large extent for building the subway and manholes, such as air chisels for cutting the pavement, trench digger, clamshell bucket, concrete mixers, etc. The work was started in March and completed in October, the average rate of laying the cable being a little over a mile per month.

SUITABLE CABLE JOINT NECESSITATED EXTENSIVE EXPERIMENTAL WORK

From an engineering standpoint the greatest problem was the designing of a cable joint that would be as reliable under the high-voltage stresses which must necessarily be withstood as the cable itself. Experimental work was started very early in 1923 on sample lengths of cable obtained for that purpose. Joints of many different kinds and dimensions were made up and then taken to a high-voltage laboratory and tested for actual performance.

Meanwhile special tools for performing the various operations required in making the joints were being developed, such as spiral cutters for removing a part of the paper insulation at the cable ends, wrapping machines for applying paper tape to the joints in the manholes, cylinders and pistons for applying compound under pressure for a short period after completion, and others.

It was not until more than six months of experimentation had been gone through with that a decision was reached as to the exact type of joint to be used.* The great care which was exercised in this development work seems to have been well worth while, and it is the consensus of opinion of visiting engineers that these joints are much superior to anything brought out previously. The machine for taping joints and two joints that are completed are shown above.

Shipments of the new cable began arriving in August, and in the latter part of that month the task of pulling the sections into the ducts was started. Joining began in September The first circuit was completed in February, and there remain only a few lengths of cable to be pulled and a few joints to make to complete the second circuit.

In order to test out the completed cable circuits before placing them in regular operation, it is desirable to apply a voltage at least twice as high as normal for a short time. For this purpose a special "kenotron set" was purchased. This set comprises a 150,000-volt transformer with regulator for adjusting the voltage and four two-electrode vacuum tubes for rectifying this test voltage to continuous rather than alternating form. The set is one of a very few which have thus far been built, and its initial performance seems very satisfactory. A maximum direct-current voltage of 200,000 is obtainable.

The amount of power which can be transmitted over either one of the cable circuits without overheating the cable is in the neighborhood of 30,000 kw. To transmit an equal amount of power at the generated pressure of 11,500 volts would require ten circuits, and even with this greater number the efficiency and voltage regulation would not be so good.

From Oak Avenue substation to the county line and thence southward the power is carried by an overhead line at 132,000 volts. Power can be transmitted over this system in either direction, and from the tertiary windings at the Oak Avenue terminal local substation feeders can be supplied. At the Lake Shore terminal and at the Oak Avenue terminal a modern transformer repair and oil house has been constructed.

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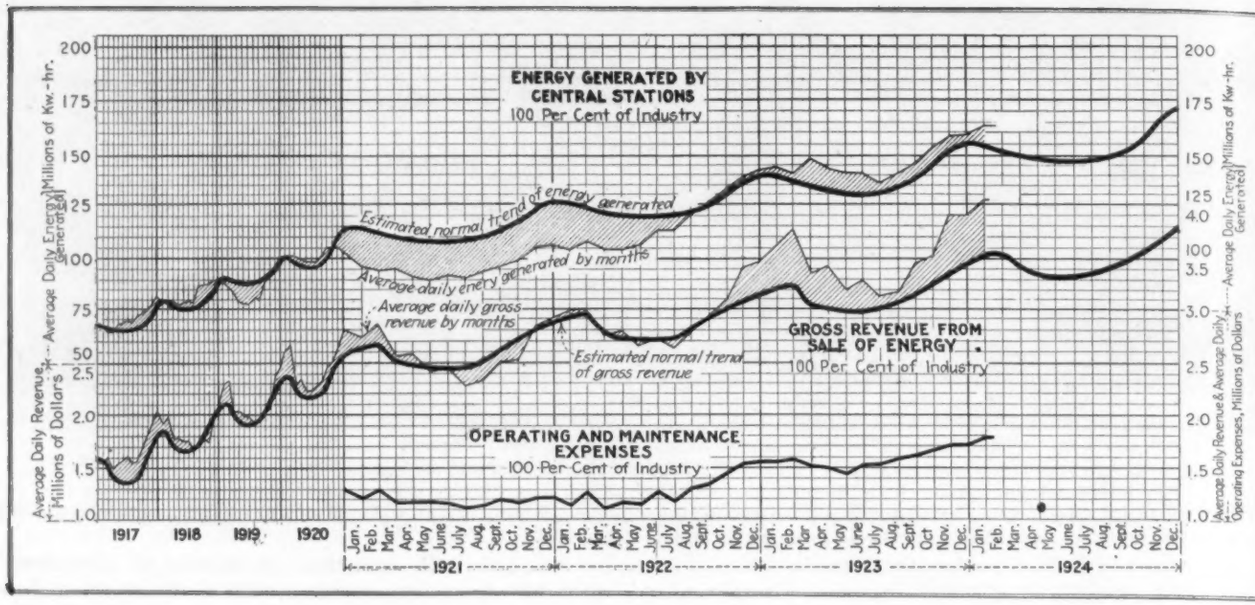
*See ELECTRICAL WORLD for Nov. 24, 1923, page 1058.

Record Central-Station Operations During January


ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
Estimated normal trend of energy generated
Average daily energy generated by months
Average daily gross revenue by months
Estimated normal trend of gross revenue
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue & Average Daily Energy Generated
Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921 1922 1923 1924

THE ELECTRICAL WORLD presents this week for the first time a greatly expanded tabulation of central-station monthly operations. Since 1913 monthly data have been collected and published by the ELECTRICAL WORLD on central-station output and gross revenue. Data on operating and maintenance expenses and operating ratio were added in 1920. As was indicated in the issue for January 5, 1924, considerable confusion has arisen in the mind of the industry by reason of the fact that four sets of figures on energy generation and output have been issued, two of them by the Census Bureau and one each by the Geological Survey and the ELECTRICAL WORLD. While each of these tabulations was basically correct within itself, yet the industry has very often used the data without a careful study of their exact basis and meaning, with resulting confusion. At a conference between representatives of these three sources of information and a representative from the National Electric Light Association an agreement was made to issue only one energy-generated or output figure in the future, this figure to be based on the term "central station" as interpreted in the Census Bureau's quinquennial census of the electric light and power industry.

In line with this agreement the ELECTRICAL WORLD will publish data on "energy generated" rather than "output" and will also extend its monthly tabulation to include an estimate of the distribution of the energy generated into total energy actually consumed by central-station customers, energy consumed for lighting purposes, energy consumed for power purposes, energy sold to electric railways, energy used in intracompany

TABLE I—CENTRAL-STATION OPERATIONS FOR THREE MONTHS

Mos.	Kw.-Hr. Generated Monthly*			Estimated Distribution of Energy Generated										Kw.-Hr. Purchased for Resale	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intra-Company Business Including Line Losses, Kw.-Hr.			
	1923, Thousands	1922, Thousands	Per Cent Increase	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands	1924, Thousands	1923, Thousands
Nov....	4,740,000	4,160,000	14.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Dec...	4,950,000	4,425,000	11.8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	1924	1923													
Jan....	5,080,000	4,490,000	13.2	4,100,000	3,622,000	707,000	614,000	2,869,000	2,517,000	524,000	491,000	980,000	868,000	733,000	538,000

* Exclusive of energy generated in Reclamation Service plants, purely electric railway plants and isolated or private plants.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS

Mos.	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1923, Thousands	1922, Thousands	Per Cent Increase	1923, Thousands	1922, Thousands	Per Cent Increase	1923	1922	1923	1922	1923	1922
Nov.....	$117,700	$101,400	15.9	$51,656	$45,700	13.0	48.2	50.4	27.3	24.3	48.6	46.0
Dec.....	121,200	107,700	12.5	52,600	48,740	8.0	48.1	49.4	26.0	28.1	43.8	47.8
	1924	1923		1924	1923		1924	1923	1924	1923	1924	1923
Jan.....	126,100	113,800	10.8	55,700	48,750	14.4	47.0	47.3	24.6	23.8	43.0	45.3

† Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

business including line losses, and the energy purchased or interchanged by central-station companies during the month. The data for gross revenue, operating and maintenance expenses and operating ratio will continue to be issued as heretofore. These details of energy distribution should meet a long-felt want in the statistics of the industry.

The central-station industry started the new year with record operations, both in the amount of energy generated and in the revenue received from the sale of energy. Of the total consumption 17.2 per cent was consumed for lighting purposes, 70 per cent for power purposes and 12.8 per cent used by electric railways.

Complete returns for central-station revenue for 1923 indicate a total of $1,269,550,000, against an estimated total of $1,300,000,000 made at the opening of this year. This decrease under the estimate is accounted for by the unusually low consumption of energy during November and December, both of which months as well as October were estimated. This total revenue is an increase of approximately two hundred million dollars over that reported by the Census Bureau and the ELECTRICAL WORLD for 1922. The operating expenses for 1923 totaled $576,880,000.

Who Sells Electrical Appliances?—VII

A City of 600,000

"Electrical World" Survey of Retail Appliance Sales in a City Where the Two Central Stations Are Not Merchandising —Non-Electrical Dealers Do 46.8 per Cent of the Business

GEOGRAPHIC location and its residential districts make the city under scrutiny this week distinctly different from the others so far included in the investigation. It has five important, well-defined shopping centers. Each is almost a complete unit in itself and caters to its particular class of trade. Although the city has a population of only a little more than half a million, it is the center of a metropolitan area of a million and a quarter, and much of the shopping of surrounding towns is naturally done in the larger city. It is the financial and shipping center for a large section of the country and is the outlet for a great quantity of fruit and other agricultural products. About three-quarters of the population of the city is native-born.

THE city described in this article is the seventh in the "Electrical World's" investigation of appliance selling by various retail dealers. So far only the larger cities, those of from 200,000 to 800,000 population, have been considered. In the next article conditions in four smaller cities and towns of 30,000 and under will be described. This will then be followed in an early issue by Article IX, which makes a composite analysis and summary of the volume and trend of retail appliance sales with a discussion of important factors affecting the business.

The two central-station companies serving the city are not in the merchandising business, except to sell electric ranges, water heaters and air heaters. The effect which this has had on the sale of appliances through the various retail channels is difficult to estimate. It appears, however, that the electrical dealers are not getting the business that would otherwise be going through the power companies. Another thing which has undoubtedly had an important bearing on the local situation is the fact that an electrical co-operative league has for some time encouraged the broadening of the channels of retail distribution of electrical appliances—that is to say, distribution through department stores, household-furnishing stores, furniture stores and hardware stores. This league of state-wide scope is doing very effective work in this city as well as in others. It has interested itself particularly in increasing the popularity of the convenience outlet and in the education of the public through electrical homes, traveling exhibits and other educational mediums. There is a contractor-dealers' organization in the city, but the feeling was generally expressed that it is more interested in developing the contracting field than that of electrical merchandising. On the whole the feeling among the electrical dealers is rather pessimistic.

Hardware stores in this city are a fairly important factor in the appliance business, there being twenty dealers who are doing an appreciable volume of appliance business. However, two large stores in the downtown shopping district were found to account for 90 per cent of the business of this group. These two stores have large electrical departments and display their goods well. In general they are satisfied with the margin of profit on appliances, favor the line and say that it is a good, clean business. Some of them complain about the cheap appliances carried by their competitors and about price cutting by hardware and other dealers. Many of them are inclined to speak lightly of the electrical dealer. They say his goods are not well displayed, that his store and windows are dirty and that he overcharges on small wiring devices and small repair jobs.

Both of the large stores approve of the central-station companies not merchandising electrical appliances. They think that the collective effort of dealers of all classes will produce a greater volume of business than if the power company sold appliances. The manager of the electrical department of hardware store "A-3" said that there is a reaction on the part of the public against cheap appliances because they do not stand up and give the service. He stated that of two gross of cheap toaster stoves which he had sold one gross came back. He had also had a sad experience with cheap percolators.

This same dealer said that one of the worst evils in

SALES OF PRINCIPAL ELECTRICAL APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES, DEPARTMENT STORES, ELECTRICAL DEALERS AND THE CENTRAL-STATION COMPANY

Kind of Dealer	Washing Machines	Vacuum Cleaners	Ironers	Flatirons	Curling Irons	Toasters	Percolators	Ranges	Waffle Irons	Small Air Heaters	Total Sales Each Class of Store	Per Cent of Total for City
Hardware Stores												
Store "A-1"	.....	.....	.....	100	50	100	75	.....	50	100		
Store "A-2"	.....	.....	.....	100	50	50	.....	.....	50	.....		
Store "A-3"	100	300	3	2,000	2,000	350	200	12	175	350		
Store "A-4"	.....	6	.....	60	60	25	36	.....	12	36		
Store "A-5"	.....	.....	.....	175	400	36	12	.....	6	36		
Store "A-6"	150	500	10	300	175	100	75	.....	50	100		
Store "A-7"	.....	.....	.....	125	75	125	75	.....	75	100		
Store "A-8"	.....	3	.....	50	50	30	12	.....	6	36		
Store "A-9"	.....	.....	.....	100	50	150	75	.....	80	150		
Store "A-10"	.....	.....	.....	125	80	130	60	.....	50	125		
Store "A-11" (10 miscellaneous)	.....	.....	.....	476	246	185	74	.....	77	114		
Total	250	809	13	3,611	3,236	1,281	694	12	631	1,147		
Value	$38,500	$48,540	$2,305	$18,490	$5,770	$8,729	$9,513	$2,100	$6,857	$10,006	$150,810	9.0
Per cent of electric appliance sales	25.5	32.1	1.5	2.2	3.9	5.8	6.3	1.5	4.5	6.7		
Household Furnishing Stores												
Store "B-1"	1,000	1,000	50	750	500	700	500	.....	100	.....		
Store "B-2"	.....	.....	.....	100	50	125	80	.....	75	100		
Store "B-3"	52	10	.....	75	6	15	15	.....	5	18		
Store "B-4"	100	300	12	1,500	500	2,000	1,000	.....	250	250		
Total	1,152	1,310	62	2,425	1,056	2,840	1,595	.....	430	368		
Value	$181,280	$78,625	$10,910	$13,700	$3,640	$15,531	$22,275	.....	$6,267	$3,462	$335,690	20.1
Per cent of electric appliance sales	53.9	22.9	3.3	4.2	1.2	4.7	6.7	.....	2.0	1.1		
Department Stores												
Store "C-1"	60	400	.....	1,500	1,500	1,000	1,000	.....	2,000	200		
Store "C-2"	90	275	10	1,350	10,000	1,800	1,000	.....	225	225		
Store "C-3"	.....	.....	.....	1,000	2,000	300	150	.....	50	1,000		
Store "C-4"	.....	600	.....	200	250	100	75	.....	25	100		
Store "C-5"	.....	250	.....	.....	.....	.....	.....	.....	.....	.....		
Total	150	1,525	10	4,050	13,750	3,200	2,225	.....	2,300	1,525		
Value	$22,500	$103,000	$1,800	$23,175	$29,300	$17,550	$16,625	.....	$34,560	$9,350	$267,860	16.0
Per cent of electric appliance sales	8.4	38.9	0.6	8.6	10.9	6.5	9.9	.....	12.8	3.4		
Furniture Stores												
Store "D-1"	.....	75	.....	125	.....	25	100	.....	.....	100		
Store "D-2"	60	100	.....	100	.....	50	25	4	25	.....		
Store "D-3"	.....	.....	.....	100	.....	25	12	.....	4	.....		
Store "D-4"	.....	10	.....	125	24	24	12	.....	12	.....		
Total	60	185	.....	450	24	124	149	4	41	100		
Value	$9,000	$11,100	.....	$2,625	$120	$930	$2,134	$700	$585	$900	$28,094	1.7
Per cent of electric appliance sales	32.0	39.4	.....	9.3	0.4	3.3	7.8	2.5	2.1	3.2		
Contractor-Dealers												
Dealer "E-1"	.....	.....	.....	200	200	75	12	.....	6	100		
Dealer "E-2"	37	50	1	500	50	45	10	.....	6	28		
Dealer "E-3"	3	12	.....	100	200	50	75	.....	25	50		
Dealer "E-4"	10	30	.....	400	150	70	40	.....	25	150		
Dealer "E-5"	2	6	.....	250	700	100	25	.....	12	150		
Dealer "E-6"	4	15	.....	300	200	24	24	.....	12	100		
Dealer "E-7"	8	56	.....	310	120	48	45	.....	36	156		
Dealer "E-8"	6	20	.....	50	25	12	.....		4	20		
Dealer "E-9" (10 miscellaneous)	17	31	.....	341	441	189	58	.....	49	171		
Total	87	220	1	2,451	2,086	613	289	.....	175	925		
Value	$13,130	$13,850	$177	$13,600	$5,225	$3,510	$3,438	.....	$2,230	$7,775	$62,935	3.8
Per cent of electric appliance sales	20.9	22.0	0.3	21.6	8.3	5.6	5.5	.....	3.5	12.3		
Electric Shops												
Dealer "F-1"	20	50	.....	600	200	100	100	.....	50	200		
Dealer "F-2"	3	.....	.....	750	150	150	75	.....	100	20		
Dealer "F-3"	60	100	12	50	100	75	24	.....	24	36		
Dealer "F-4"	.....	.....	.....	83	120	56	65	.....	10	42		
Dealer "F-5"	300	1,500	.....	1,400	3,000	1,200	240	.....	100	500		
Dealer "F-6" (4 miscellaneous)	3	14	.....	324	130	142	50	.....	76	100		
Total	386	1,664	12	3,207	3,700	1,723	554	.....	360	898		
Value	$58,300	$105,000	$2,130	$17,750	$9,238	$9,850	$6,580	.....	$4,525	$7,550	$220,923	13.2
Per cent of electric appliance sales	26.4	47.5	1.0	8.0	4.2	4.5	3.0	.....	2.0	3.4		
Specialty Stores												
Dealer "G-1"	.....	12	.....	6	.....	2	.....	.....	.....	.....		
Dealer "G-2"	.....	3,000	.....	.....	.....	.....	.....	.....	.....	.....		
Dealer "G-3"	520	550	130	.....	.....	.....	.....	.....	.....	.....		
Dealer "G-4"	650	300	.....	.....	.....	.....	.....	.....	.....	.....		
Dealer "G-5"	.....	60	.....	.....	.....	.....	.....	.....	.....	.....		
Dealer "G-6"	100	450	.....	.....	.....	.....	.....	.....	.....	.....		
Dealer "G-7"	35	350	.....	140	50	15	20	.....	10	45		
Dealer "G-8"	100	100	.....	27	100	40	6	.....	4	25		
Total	1,405	4,822	130	173	150	57	26	.....	14	70		
Value	$212,390	$303,780	$23,068	$942	$375	$318	$314	.....	$149	$582	$541,918	32.4
Per cent of electric appliance sales	39.2	56.0	4.3	0.18	0.07	0.06	0.06	.....	0.03	0.1		
Central-Station Companies												
Company "H-1"	.....	.....	.....	.....	.....	.....	.....	205	.....	.....		
Company "H-2"	.....	.....	.....	.....	.....	.....	.....	152	.....	.....		
Total	.....	.....	.....	.....	.....	.....	.....	357	.....	.....		
Value	.....	.....	.....	.....	.....	.....	.....	$63,120	.....	.....	$63,120	3.8
Per cent of company's electrical appliance sales	.....	.....	.....	.....	.....	.....	.....	100	.....	.....		
Grand Total												
All dealers	3,490	10,535	228	16,367	24,002	9,838	5,532	373	3,951	5,033		
Value	$535,100	$663,895	$40,390	$90,282	$53,668	$56,418	$70,879	$65,920	$55,173	$39,625	$1,671,350	100.0
Per cent of total appliance sales	32.0	39.6	2.4	5.4	3.2	3.4	4.2	4.1	3.3	2.4	100.0	

the electrical business is the practice of electrical jobbers in selling goods wholesale to others than bona-fide dealers. This condition, he declared, does not exist in any other line of merchandise, and he blamed the electrical jobber for failing to protect his dealers. He is not in the electrical range business, because, he said, the power companies sell ranges at less than his cost. Ranges should be sold on such a basis that the dealer could take the lead and carry a stock, according to his views. In his opinion it is the high cost of installing services for electric ranges that is standing in the way of their sale.

It was found that a large percentage of the hardware dealers buy through hardware jobbers because, as they stated almost universally, they get better service from the hardware jobbers. Many of them said that the electrical jobbers employ inexperienced young boys. As a consequence the jobbers' labor turnover is so high that a customer seldom gets the same man twice when calling on the telephone. Furthermore, the hardware jobber's salesman calls on even the small dealer twice a week, whereas the electrical jobber's man calls once every two weeks or possibly not at all. It is only natural, according to these dealers, that they should buy through the hardware jobber with whom they have been doing business for years. The appliance business of this group is increasing at the rate of about 25 per cent a year, and consequently the hardware store offers a growing market for electrical goods.

HOUSEHOLD-FURNISHING STORES

Two large household-furnishing stores were found to be doing 92 per cent of the business in this group. Of these, one specializes in washing machines and vacuum cleaners and 93 per cent of his sales consist of these items. He has three stores in the city and employs a large house-to-house sales force. The other household-furnishing store, "B-4," has an excellent sales organization. It handles only reputable merchandise and has a very good standing in the community. The aggressiveness of this firm is responsible for the fact that its electrical appliance business is increasing at the rate of from 20 to 25 per cent a year.

The assistant manager of the store has the reputation of being something of an authority in his field. He holds out little hope for the electrical dealer to increase his appliance sales, holding that the latter does not know how to display his goods, advertise or merchandise. He says that the situation the electrical dealer finds himself in today is entirely his own fault and he does not worry about competition from this class of dealers. He finds that the easy-payment plan is the only way in which to sell the heavier appliances. He expects the electric range to become popular, but there is not now a sufficient margin of profit to pay his firm to handle them. At one time they carried ranges but dropped out of the business because of competition of the two power companies. The electric range costs too much today, and the price must come down before it will be a serious competitor of the gas range, according to this manager's views.

In his opinion servicing of electrical appliances is most important to the successful dealer. His store gives a one-year guarantee on everything it sells, and several men are employed who service electrical appliances. He feels that the electrical co-operative league has done some very good work, but that its efforts at the present time are not producing the results they should. His firm has been a member of several electrical organizations at different times but has dropped out of all of them. He said that he had been instrumental in helping to organize the electrical dealers of the city several times, and that after giving these men trade secrets, as it were, in an endeavor to help them and doing everything he could to assist them, they did not show enough interest to attend the meetings. He strongly commended the power companies for the position they have taken in staying out of the merchandising business.

DEPARTMENT STORES

Of the five department stores selling electrical appliances, two are doing a large volume of business and offering "quality" merchandise only. All of the stores are very well satisfied with the appliance business and are showing about a 20 per cent increase in their annual sales volume. The two larger stores do not cut prices, but occasionally offer "specials." They are not worrying about competition from any of the other classes of dealers and pay no attention to price cutting by their competitors. The stores are unanimous in their views on the question of central-station merchandising. They feel that the present retail outlets are capable of handling the situation satisfactorily.

The manager of the household-furnishing department of store "C-1" said that he does not think the department store is in a position to sell electric ranges today because of the technical nature of these appliances and the necessity of employing some one who thoroughly understands them.

The manager of the electrical department of store "C-2" does not think the electrical dealer has any chance to survive unless he changes his policy. Electrical dealers, in his opinion, should add other lines of merchandise to their appliances to attract the women shoppers.

FURNITURE STORES

Although several furniture stores are handling electrical appliances, they are not an important factor in the situation and are not likely to become so because they handle appliances merely to enable them to offer a customer everything necessary completely to furnish the home. All of these stores handle high-grade appliances and do no price cutting.

ELECTRICAL DEALERS

Widely varying opinions were expressed by the different electrical dealers of all three classes, and very often they did not take a stand which was in agreement with the opinions expressed by dealers in other lines. The best of relations do not exist among the electrical dealers themselves. The majority show little interest in their appliance business, and very few of them have good store locations or display their merchandise to advantage. Nearly all have something to complain about. Many accuse their competitors, particularly the hardware dealers, of cutting prices, and they complain about the cheap appliances carried by the hardware stores. Some dealers blame the jobber for allowing price cutting, and some say that the only one who can stop the practice is the manufacturer. The one universal complaint they make is that the electrical jobbers sell at wholesale prices to those who are not entitled to discounts and thus the dealers have no protection. Dealer "F-5" said that 50 per cent of his customers come in to look around and then say that they can get the particular article they are interested in at

wholesale. For this reason, he says, he carries a line of cheaper appliances with his name on them which he buys directly from the manufacturer, to be assured that people cannot use this excuse not to buy.

ELECTRIC SHOPS AND SPECIALTY STORES

Both the electric shops and specialty stores doing a comparatively large volume of washing-machine and vacuum-cleaner business employ house-to-house salesmen, and a big majority of their sales are made by these crews. In the case of store "F-3," one-half the sales are closed by outside men, and in stores "F-4" and "F-5" 75 per cent of the business is done through selling at the customers' premises.

The specialty stores depend almost entirely on house-to-house selling. The owners of stores "G-2." "G-4," "G-5," "G-6" and "G-8" declared that 95 per cent of their sales were consummated by outside salesmen, while the percentage for "G-3" and "G-7" was placed at 70 and 75 per cent respectively. The fact that store "G-1" has no outside selling force is strikingly reflected in its small volume of sales.

Dealer "E-5," who has had fifteen years' experience in the contracting and merchandising business, said that contracting and the appliance business in the small store do not mix. The owner of the business must be either a good contractor or a good merchandiser, but he seldom is both, and either his contracting or his merchandising business is bound to suffer. If his business is large enough to warrant employing a man qualified to make up the deficiency, and if he will add other lines of goods to his electrical line, such as gas appliances, silverware, household furnishings, hardware, etc., he will, in this dealer's opinion, fare much better.

Neither the electrical contractor-dealers' organization nor the co-operative league seems to have accomplished much in promoting appliance sales by electrical dealers. Several dealers were found who were getting out of the merchandising business just as fast as they could. Some of these men have been in the business from ten to fifteen years. One man said there was no use trying to compete with the hardware stores, household-furnishing stores and department stores because they put on specials on electrical appliances to get the people into the store and then overcharged them on something else to make up for it. He also declared that people come in to buy an electric flatiron and expect a life guarantee on it, but the same persons will pay $15 for a pair of shoes and throw them away within two weeks.

COMMENTS ON CENTRAL STATIONS' POLICY

With a unanimity of opinion which should perhaps be discounted on the ground of its self-interest, the dealers of all classes in the city were agreed in commending the two power companies for staying out of the appliance business. There were two or three dealers, however, who felt that if the power companies were in the merchandising business and would maintain list prices on appliances, the dealers of the city might do a larger volume of business by reason of the greater demand created by the power companies' advertising and aggressive sales methods. About the only criticism of the power companies was against their electric range policy. The dealers feel that the central stations should protect them on the price of ranges so that they might be able to go after the business.

An official of one of the power companies is firmly opposed to merchandising by the central station. He feels that the company's relations with the dealers and the public are much improved by his company's policy of assisting the dealers and letting them handle the appliance business. This company has a plan of holding meetings in its various districts and inviting in all classes of dealers selling electrical appliances for the purpose of assisting them and bringing about better co-operation. These meetings have been very successful and much good is being accomplished by them. The sales manager of the other power company said: "As long as the appliance business can be well done by specialists in that line it is better for the power company to devote its energy toward getting new business and building good will."

Both power companies sell electric ranges, but their policy at the present time is not such as to make it possible for the dealers to do any great volume of range business. They sell ranges at cost plus a certain percentage and wire them in at a fixed price. Dealers making sales receive a commission. One company takes over the sale and handles the payments while the other does not. One of the companies feels that the electric range has passed the pioneering stage and that the dealers should be encouraged to handle ranges, and this company is endeavoring to put the range business on a basis where the dealers can make a sufficient profit to warrant their going after this class of business aggressively. One company is a combination gas and electric company, but nevertheless is actively pushing electric ranges and feels that there is a good future for the business.

CONCLUSION

The investigation in this Western city indicates that the electrical contractor-dealer is a small factor in the appliance business, although the accompanying tabulation shows the three classes of dealers in the electrical group to be doing nearly half of the appliance business. It will be seen that the eighteen contractor-dealers interviewed are doing only 3.8 per cent of the appliance business, the nine electrical stores handling appliances, portable lamps and fixtures 13.2 per cent, and specialty stores and factory branch stores, of which there are eight in all, are doing 32.4 per cent of the business.

Of the total appliance business, non-electrical dealers of all kinds account for 46.8 per cent divided as follows: Hardware stores, 9 per cent; household-furnishing stores, 20.1 per cent; department stores, 16 per cent, and furniture stores, 1.7 per cent. The limited merchandising efforts of the two central-station companies amount to 3.8 per cent. Almost one-half of the electrical appliance sales are made by non-electrical stores.

It is interesting to look at the situation after eliminating washing machines, vacuum cleaners, ironers and electric ranges, and take only the smaller appliances, i.e., flatirons, curling irons, toasters, percolators, waffle irons and small air heaters. On this basis the hardware stores are doing 16.2 per cent of the business, the household furnishing stores 17.7 per cent, the department stores 38.5 per cent, the furniture stores 2 per cent, and the three classes of electrical dealers combined 25.6 per cent.

It is thus seen that the hardware stores, household-furnishing stores, department stores and furniture stores are doing 75 per cent of the small-appliance business, and at the present rate of increase in their sales, which averages about 20 per cent a year, it will be only a matter of a few years until the electrical

dealer will be practically out of the appliance business, unless something happens to check this trend. In fact, there are only three or four electrical dealers out of the thirty-five interviewed that are doing a straight appliance and portable lamp and fixture business. All of the others are handling some side or supplementary line, such as radio equipment, or else they specialize on washing machines, vacuum cleaners, sewing machines, etc., using house-to-house salesmen, and sell the smaller appliances more as a side line. Out of the thirty-five electrical dealers in the city there are only eight of any importance that are doing a combined contracting and merchandising business, and almost without exception these establishments carry radio as a side line. As a matter of fact, however, radio appears to have been the means of tiding over a number of the contractor and other electrical dealers.

Appliance selling in this city is unmistakably extending into wider channels, and the hardware stores, household-furnishing stores and department stores are becoming increasingly more important factors. Just what is going to happen to the electrical dealer as an appliance outlet is hard to foresee, but it would appear that if he is even to hold his present position he will have to devote more careful study to his merchandising problems and follow the cues of some of his successful non-electrical competitors.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

How Can an Operating Esprit de Corps Be Built Up?

To the Editors of the ELECTRICAL WORLD:

I have been interested in following the articles in the ELECTRICAL WORLD under the caption "Extracts from an Operating Code," applying particularly to the Philadelphia Electric Company, as I believe that this code contains much information.

However, I am not only concerned in the formation of the code or rules, but even more desirous of obtaining information as to a way of putting such a code into effect. The best set of rules in the world would be of no value unless there was some method of enforcing them, either from the operating office or automatically from the men themselves. In brief, to my mind, the most important function of an operating code consists not only in giving the standards under which apparatus should be operated but also in building up the esprit de corps of the operating personnel itself.

Berkeley, Cal. GEORGE F. WHITWORTH.

Prefers English to Latin Nomenclature

To the Editors of the ELECTRICAL WORLD:

I have been interested in Professor Karapetoff's suggestion of the classification of harmonics and the nomenclature to be applied. We have been confronted in our work for some years with the necessity of distinguishing between the classes of harmonics which you mention and, without resorting to Latin, we have used simply the English words "triple" and "non-triple," or one may say "triples" and "non-triples." I do not see the necessity or the desirability of coining other words when we have the equivalent words in English and are economizing by one letter. In reference to his alternate proposal of the terms "monophase" and "polyphase," I do not think that they are so appropriate, for, while we may have harmonics generated in a polyphase manner, for instance, these same harmonics, owing to unbalances in the line, may have a monophase component in the circuit, composed of the three conductors of the transmission line for one side with ground for the other side. LIVINGSTON P. FERRIS.

American Telephone & Telegraph Company,
New York, N. Y.

Relative Advantages of 50-Cycle and 60-Cycle Design

To the Editors of the ELECTRICAL WORLD:

In regard to the article by Minoru Fukuda, in the February 23 issue of the ELECTRICAL WORLD, on the Japanese frequency problem I should like to offer a few observations in support of the 50-cycle system:

It is true that in the case of transformers 60 cycles has an advantage in the matter of weight, size and cost. Voltage regulation, however, is not necessarily in favor of the higher frequency; at low power factors 50 cycles has the advantage, though the difference either way is very small.

Comparing two generators similar in other respects, the higher-frequency machine will be the smaller because it runs at higher speed; but in the case of steam turbo-generators a two-pole, 50-cycle design can be carried to much higher capacities than one of 60 cycles, with consequent saving in size, weight, cost and water rate, besides the increased reliability of the smaller castings and forgings. In England, for instance, two-pole machines have been built for 20,000 kva. to 25,000 kva., whereas the largest two-pole, 60-cycle machine at present I believe to be of 9,375 kva. capacity, though I am open to correction here.

In his paragraph on transmission lines the author attempts to turn the disadvantage of poorer regulation at the higher frequency into an advantage by means of synchronous condensers—a most illogical argument. Questions of the relative severity of short circuits and corona have no practical significance as there is so little difference between the frequencies.

There is no appreciable advantage either way in regard to efficiencies and power factors of motors, though the 60-cycle system allows a speed of 3,600 r.p.m. by direct drive if such a speed is ever needed. The low-frequency synchronous converter is inherently a better proposition; there is not much difference, of course, but the fact that a 50-cycle converter can be designed for 1,500 volts, having the same commutating characteristics as a 60-cycle machine at 1,200 volts, is of some importance in direct-current railway work. In regard to extra-high-tension cables, the lower frequency is better owing to dielectric hysteresis, which is one of the limiting functions in the design of such cables.

To sum up: The 60-cycle system scores as regards transformers, with their oil tanks, and hydro-electric generators. The lower frequency, however, wins out with steam turbo-generators, transmission lines, commutating machinery and extra-high-tension cables, and it should therefore bear the palm for general utility.

Tampico Electric Co., Ltd., E. C. HARRIS,
Tampico, Mexico. Assistant Engineer.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Construction Estimates and Their Purpose

By R. J. Davidson
Pacific Power & Light Company, Portland, Ore.

Cost and earning power are important factors in all construction enterprises, and their relative values determine whether expenditures for plant additions shall be approved or denied. On a large system such as that of the Pacific Power & Light Company, serving a number of communities in eastern Oregon and Washington, it is necessary to work out a rather elaborate system for handling expenditures for betterments. It is the purpose of this article to outline the essential features of the system this company has adopted and to follow the routine for the various forms used.

The accounting system requires a properly approved expenditure requisition for every item entering the plant account. These expenditure requisitions are divided into two classes, blanket and special. The blanket expenditure requisitions are further divided into two groups, the service-extension blankets and the miscellaneous blankets. The service-extension blankets, a sample of which is shown in the accompanying illustration, cover the cost of short extensions, service connections, meters and similar installations necessary to render service to customers. The miscellaneous blankets cover the purchase of automobiles, furniture and fixtures, instruments, tools and other small miscellaneous additions properly chargeable to the plant account.

The blanket expenditure requisitions are authorized to cover only those individual jobs which will cost less than $500 each. They are estimated as a lump sum for the year. Each separate job under a blanket requisition must have an individual authorization. These individual authorizations are called work orders for the jobs under the service-extension blankets and small-property orders for the jobs that fall under the miscellaneous blankets. Every small-property order must be properly approved in the general office before charges to it can be accepted. Work orders in amounts less than $50 can take charges after being properly approved in the district office, but for costs between $50 and $500 they must first be approved in the general office. All property additions amounting to more than $500 must

Form H
FOR GENERAL OFFICE FILES

General Office E.R. No. 3027
Local Office Temp. No.

PACIFIC POWER & LIGHT COMPANY
REQUISITION

Feb. 17, 1923.

Sir :--Below please find description, estimate of cost, time required to complete and benefits to be derived from, construction and/or improvement work in connection with this property, which work we recommend be undertaken.

(a) Description of work:

SUNNYSIDE, WASH. - JAS. SMITH ELECTRIC SERVICE INSTALLATION

Covers the installation of 4 poles, 3 spans of 3-phase 2300-v. primary, transformer platform, three 25-Kva transformers, service drop, metering equipment, etc as shown in detailed estimate.

(b) Estimate of cost: Date completed 192

Item No.	ITEMS	Book Value of Material on Hand	Amount to be charged to Maint'ance	Amount to be charged to Reconstr'ct'n	Amount to be charged to Construct'n	Total Estimated Cost	ACTUAL COST Maintenance	ACTUAL COST Construction	Total Actual Cost
70	Poles	$ 50	$ 3		$ 77	$ 80			
71	Crossarms, Wire, etc.	46	3		54	57			
73	Transformers, Service and Meters	42			823	823			

(c) Details of Estimate of Cost:

Group No.	Item No.	ITEMS	Quantity	Unit	ITEM COST Unit	ITEM COST Total	Item Total	Group Total	Group No.

(d) Analysis of Actual Cost:

Item No.	ITEMS	Quantity	Unit	ITEM COST Unit	ITEM COST Total	Item Total	Group Total

Form No. [illegible]

PACIFIC POWER & LIGHT COMPANY

PREPARED A.R.C. DATE 2/17/'23
CHECKED R.J.D.
APPROVED H.H.S. CH. ENGR.

SUNNYSIDE, WASH. - JAS. SMITH ELECTRIC SERVICE INSTALLATION

E. R. 3027 CLASSIFICATION Gen'l.
NO. OF SHEETS 3 SHEET NO. 1

NUMBERS Ea.	NUMBERS Ov.	NUMBERS It.	ARTICLE	QUANTITY	UNIT USED	UNIT COST	TOTALS ITEM MCN.	TOTALS ITEM RCN.	TOTALS DIVISION MCN.	TOTALS DIVISION RCN.	TOTALS GROUP MCN.	TOTALS GROUP RCN.	DESCRIPTION AND REMARKS
70	Al		Poles								77	3	
		a	Cost f.o.b. Stores - 35 ft. Cedar	4	ea.	$ 12.50	$ 50						Four new poles to be located as shown on map.
		c	Hauling	4	poles	1.25	5						
		d	Labor	4	"	5.50	22						
		w	Removing old pole	1	ea.	3.00		3					One existing pole to be removed.

REQUISITION FORMS USED FOR BETTERMENT EXPENDITURES

Top—Service extension form. Bottom—Detailed items and costs form. Center—Reverse side of detailed form.

be covered by a special expenditure requisition approved in the general office. All estimates for work orders and small-property orders, as well as the majority of special-extension requisitions, originate in the district or department offices.

When an estimate is received in the general office it is first checked in the engineering department. The quantities are checked to determine if sufficient material has been estimated for the job. The material is checked to determine if proper sizes and kinds have been specified. Consideration is given to the effect of the work on plans for the future. Material unit costs are checked against current market prices if the material must be purchased. When the material is in stores and can be reserved for the job the indicated store prices are used. The labor costs are checked with special reference to local conditions and seasonal changes in the weather. A certain percentage of the total labor and material cost is added to cover overhead expense. This percentage is an average of actual expense on many jobs taken over several years' time.

Maps are submitted with field estimates and must necessarily be relied upon to give much information, and errors in them are objectionable and give rise to inaccurate estimates. A map or sketch submitted with an estimate must show clearly and on a workable scale the location, extent and principal features of the proposed addition. On extension maps some "tie-in" is given to definitely located points, such as section lines or corners, street intersections or the like.

After the estimate has been checked by the engineering department it is sent to the operating department, where the revenue, future business possibilities and other features are considered, and it is then approved or rejected by the proper official. When a work or small-property order is approved a signed duplicate copy of the preliminary papers is returned to the district office. A special printed form is used for the authorization notice when a special-expenditure requisition is approved. If the proposition is rejected the information is usually conveyed in a letter stating the reasons.

After the work is completed under a special requisition and all charges have been entered in the construction ledgers an analysis is made of the cost. This analysis is used to determine whether the equipment estimated has been installed as authorized. It forms a record of the installation and serves as a guide in estimating future additions of a similar nature.

Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

Circuit Pin Positions and Transpositions

Pin Positions.—Where through or trunk primary and series lighting circuits exist they shall be placed on the top arm and local primary and series lighting circuits on the second arm. Secondary circuits shall be placed 7 ft. below the primary cross-arms, as shown in Fig. 2 (see ELECTRICAL WORLD for Jan. 19, 1924, page 144). No primary circuit or series lighting circuit of more than 500 volts maximum shall ever be placed on a cross-arm carrying secondary or signal circuits.

In general, 6,900-volt circuits shall be carried on the two end pins and one of the pole pins and no wires of lower voltage shall be carried on the same cross-arm with such a circuit (Fig. 36B, (see ELECTRICAL WORLD for March 29, 1924, page 630).

All primary circuits of 4,000 volts and less shall occupy the pole and middle pins, and series lighting circuits the end pins. The end pins of cross-arms which do not now carry series lighting circuits should be left vacant if it is likely that such circuits will ever be installed.

Circuits shall hold the same pin posi-

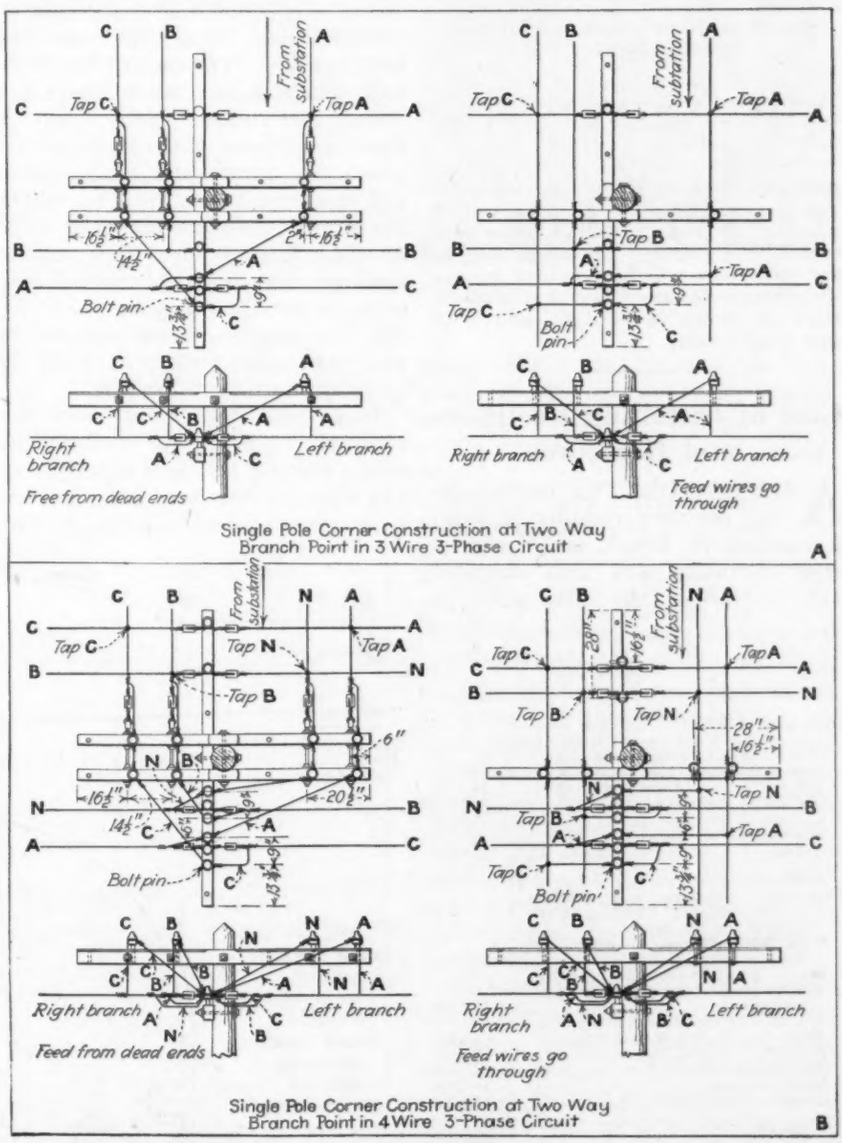


FIG. 37—CIRCUITS SHALL HOLD SAME RELATIVE POSITION THROUGHOUT

tion throughout the entire length and the conductors shall be run so as to maintain the same relative positions from left to right with back to the source of power at any point, as shown in Fig. 38. For construction at two-way branch points see Figs. 37A and B.

The neutral of 4,000-volt, four-wire,

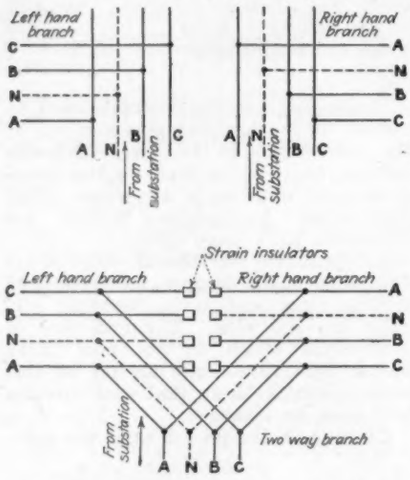


FIG. 38—CONSTRUCTION OF TWO-WAY BRANCH POINTS

three-phase circuits shall hold the left-hand pole pin position with back to the source of power at any point.

Transpositions. — In general, transpositions shall be made only in 6,900-volt or 12,000-volt circuits which parallel telephone toll lines for a considerable distance. Locations for all transpositions will be specified by the distribution engineer, and they shall be made as shown in Fig. 36C and D of last week's issue.

Cost of Installing Rectifiers and Reactors

A MASSACHUSETTS central-station company recently replaced a number of Brush arc machines with rectifiers and also installed two reactors at the same plant in connection with interstation lines. The labor, material and total costs of this work are given herewith.

COST OF INSTALLING RECTIFIERS AND REACTORS

Installing three 75-light, 5 amp. rectifiers to replace Brush arc machines in generating plant:	
Three mercury-arc rectifiers	$9,767.37
700 ft. No. 1-0 flame-proof cable	231.00
100 cable supports	72.00
51 pipe fittings	30.24
Miscellaneous	72.24
Labor	774.29
Total	$10,947.14
Installing reactors and control equipment for additional interstation tie lines:	
Two Metropolitan 300-amp., 72-kva. reactance coils	$1,834.36
Eight single-pole, single-throw, 300-amp. for 15,000-volt switches	176.00
115 ft. 500,000-circ.mil cable	73.72
Four No. 15,142 insulators	41.00
Four No. 15,162 insulators	90.00
Two potheads	45.00
Miscellaneous	106.25
Labor	489.12
Total	$2,855.45

Repairing Seal Sections of Reaction Turbines

BY FREDERICK KRUG
Superintendent of Hydro-Electric Plants
Porto Rico Railway, Light & Power Company, Bayamon, Porto Rico

THOUGH practically all reaction turbines on the market today are provided with renewable runner and seal rings, there are many old-style turbines in service which, except for badly eroded scroll casing around the runner, with consequent reduction in efficiency, are still capable of considerable service.

The eroded scroll case on the head side of a 750-hp., 450-r.p.m. turbine operating under a head of 175 ft., that has been in service since 1907, is shown in Fig. 1. A similar condition existed on the draft side of the scroll case, though the wear was not so severe. The face of the draft bend had also been worn where the runner had rubbed. As a result of these conditions the clearance between the runner and seal sections had increased to almost ¼ in. where the original clearance had been ⅛ in. As the efficiency under these conditions was very poor and the unit was to be in service for some years before replacement, it was decided to undertake such repairs as could be made without much expense.

Three cast-steel rings were accordingly made up for insertion at points marked 1, 2, and 3 in Fig. 2. The ring for the head side, marked 1, is shown in detail in Fig. 3. The

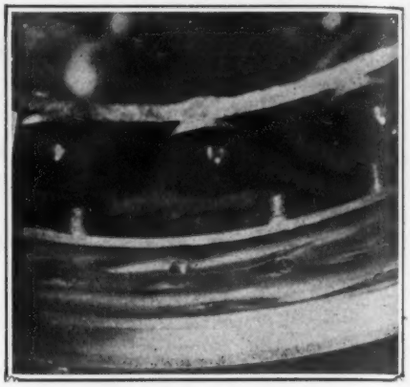


FIG. 1—ERODED SCROLL CASE OF TURBINE

scroll case was then bored out and the rings were carefully fitted in place. That on the draft-bend face was mounted with bolts, the heads of which were later removed. All dimensions were made to conform as nearly as possible to the original ones, except that the inner diameter of the new rings was smaller to compensate for peripheral wear.

The balancing ring was carefully adjusted so that the clearance be-

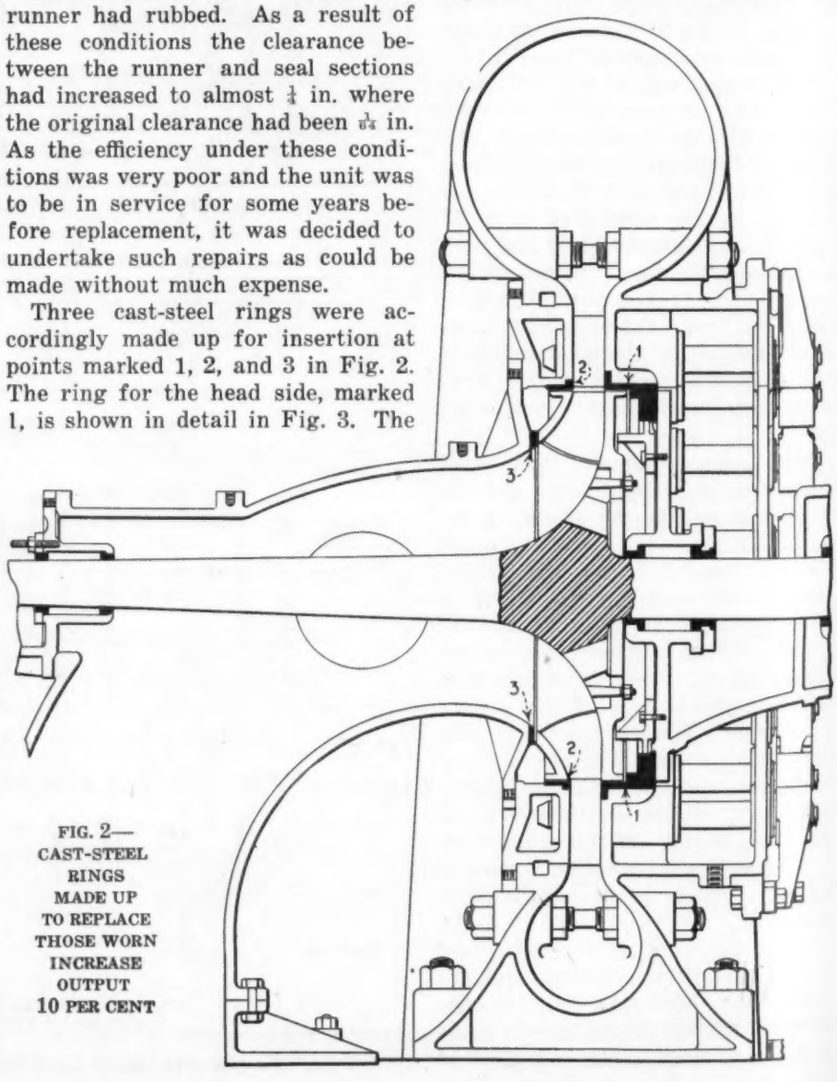


FIG. 2—CAST-STEEL RINGS MADE UP TO REPLACE THOSE WORN INCREASE OUTPUT 10 PER CENT

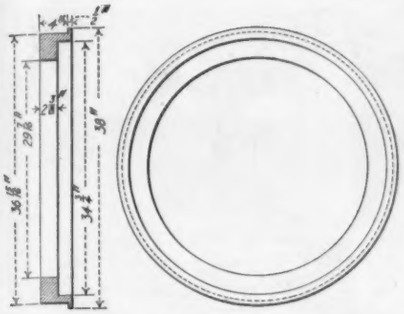


FIG. 3—DETAIL OF RING FOR HEAD SIDE OF TURBINE

tween it and the runner was equal to the clearance between the runner and the draft-bend face when the runner was on center.

Coal Test Data Form

THE coal test data form shown herewith is used by the Federal Light & Traction Company to cover the analysis of all samples of coal submitted by the various properties to the central laboratory at Trinidad, Col. It is prepared at the laboratory from tests made on the various samples of coal that are received.

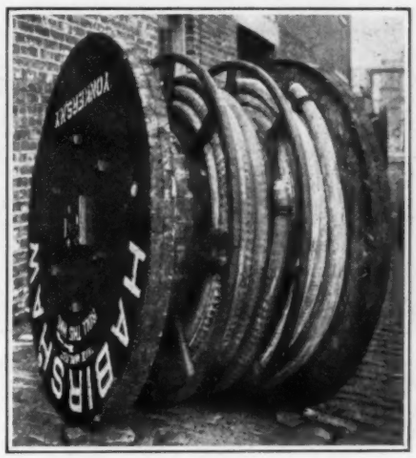
An interesting part of this form is that which gives the cost of the coal at the mine, in the bin, after burning and finally the total cost burned, including ash handling.

Sectionalizing Frames for Cable Reels

BY CARROL H. SHAW
Engineer Distribution and Installation Department, New York Edison Company

THE accompanying illustration shows a new type of sectionalizing frame developed for temporary attachment to standard cable reels for holding short sections of large feeder cable. The frames are of simple yet rigid design, being assembled from 1-in. wrought-iron pipe, firmly welded at all joints and constructed in such a manner as not only to provide for interchangeability on all large standard reels but also for rapid attachment and detachment.

When it is desired to place several sections of cable on a single reel, one, two or even three frames are first put on, depending on whether two, three or four divisions are needed. The cable is then reeled on in the usual manner, the outer end being fastened with marline to the most convenient spoke of the adjacent frame. In order to keep the records clear the first or left-hand section is called the "middle"—or "left middle," if there are four—and the last section is designated as the "outside"



REEL FOR HOLDING SHORT SECTIONS OF CABLES

piece. When one or more of the pieces of cable are needed for installation, they may be reeled off onto single drums before delivery to the field.

The cost of the frames is considerably less than the investment required to provide the reels that they displace. As the diameter of the frames is about an inch less than that of the reel ends, there is no damage to the frames from ordinary use, even though the reel itself is weak or defective. In the transportation of short pieces of cable to and from the storeroom a large saving is made, since an ordinary 5-ton truck cannot carry more than three large reels, no matter how small the sections of cable, whereas if the frames are used so that the short pieces of cable may all be put on one reel, an additional full reel can be handled.

In ordinary service the frames are very satisfactory. They require no special tools to fit them to the reels, and they are of such sturdy construction that no care or attention above that ordinarily required for the reel itself is necessary.

COAL TEST DATA

THE FEDERAL LIGHT & TRACTION COMPANY

Trinidad June 5th. 1923 19

Property Las Vegas Light & Power Co. Dept. Elec.

Identification of Sample

Car Initial	AT&SF	AT&SF	AT&SF	AT&SF	AT&SF
Car Number	84193	171089	81299	171647	171072
Date Sample Was Taken	4/1	4/5	4/13	4/16	4/17
Kind of Coal	Slack				
Trade Name	Swastika				
Name of Mine	Sugarite				
Location of Mine	Sugarite N.M.				
Seller	Swastika Fuel Co. Raton N.M.				

Proximate Analysis—By F.C.Miller

Test Number	8738	8739	8740	8741	8742
Per Cent Moisture	1.20	2.00	2.70	2.00	2.25
Per Cent Ash	16.31	15.00	12.26	17.74	18.38
Per Cent Sulphur					
Per Cent Volatile					
Per Cent Fixed Carbon					
B-T-U-Per Lb. Dry	12,440	12,618	13,092	12,186	12,028
B-T-U-Per Lb. Moist (As Fired)	12,291	12,366	12,739	11,944	11,758

Cost Data

Cost Per Ton at Mine	2.95	2.95	2.95	2.95	2.95
Freight Per Ton	2.07	2.07	2.07	2.07	2.07
*Cost of Unloading, Per Ton	.10	.10	.10	.10	.10
Total Cost in Bin, Per Ton	5.12	5.12	5.12	5.12	5.12
*Cost of Firing, Per Ton	.88	.88	.88	.88	.88
Total Cost Per Ton Burned	6.00	6.00	6.00	6.00	6.00
*Cost of Ash Handling Per Ton	.13	.13	.13	.13	.13
Total Cost Per Ton Burned Including Ash Handling	6.13	6.13	6.13	6.13	6.13
Cost Per Million B-T-U-Moist, in Bin	.21	.20	.20	.21	.22
Cost Per Million B-T-U Including Firing and Ash Handling	.25	.24	.24	.25	.26

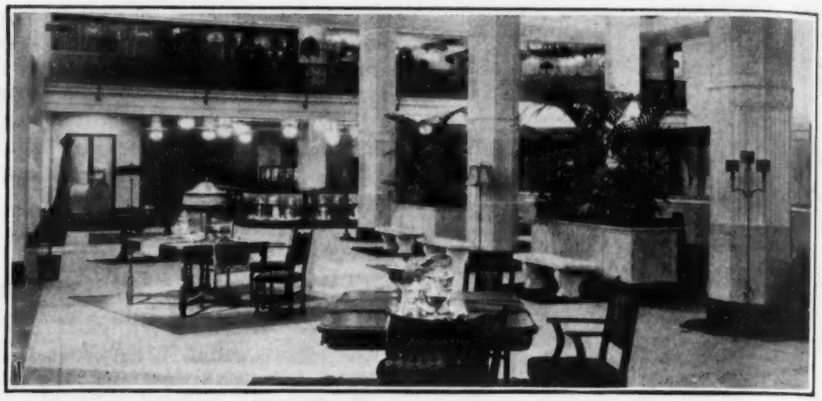
Remarks:

*From Monthly Average

Manager or Superintendent.

FORM FOR RECORDING COAL ANALYSIS

San Joaquin Power Building a Monument to Better Public Service



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THE new ten-story office building of the San Joaquin Light & Power Corporation at Fresno, Cal., represents another advance in a utility's service to the public. Since the occupation of the new quarters company officials estimate that the adequate space and consequently better comfort for all employees have increased efficiency at least 25 per cent. Some views of the San Joaquin company's new home are shown here.

No. 1. General lobby.

No. 2. The consumers' department occupies the entire second floor.

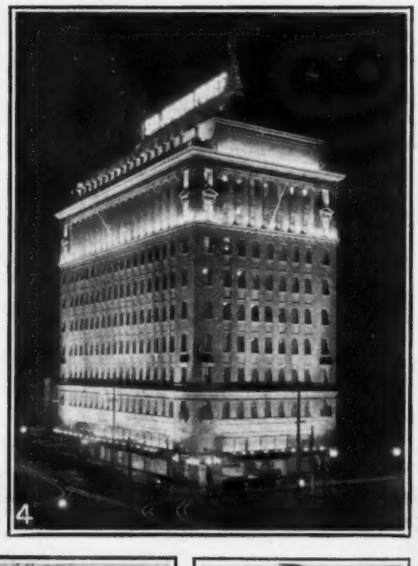
No. 3. A view of the consumers' counter in the main lobby, where applications for service are made, adjustments looked after and bills paid.

No. 4. Night view of San Joaquin Power building.

No. 5. Medical department showing modern X-ray equipment.

No. 6. Compressors of refrigerating plant. A small plant with a capacity of 4 tons is used for cooling the water.

No. 7. Telephone exchange. There are four switchboards, two being used to handle calls on the outside or Pacific telephone and two for calls on the private lines of the company.



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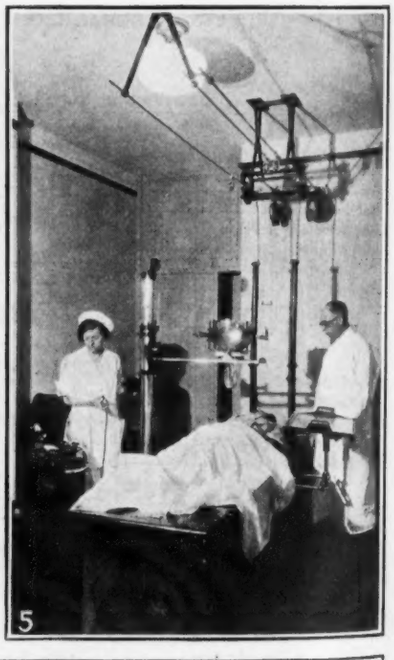

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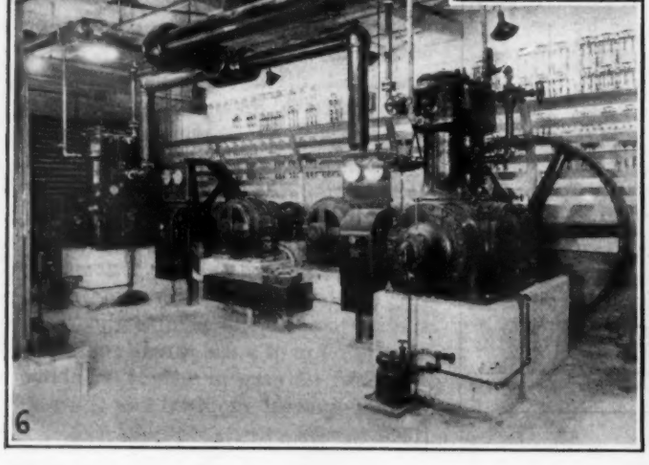

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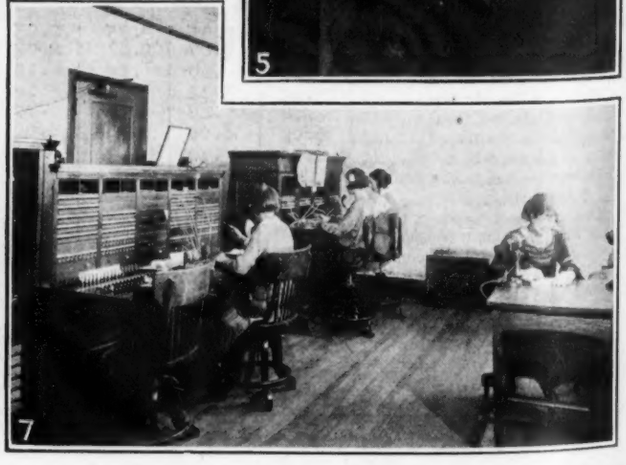

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Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Heating and Power Requirements of Office Buildings

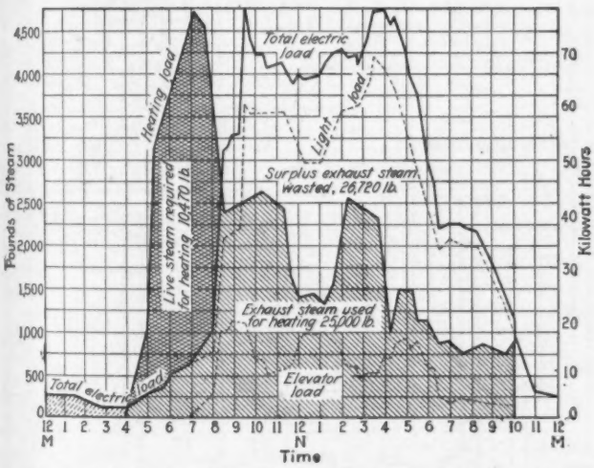
By F. F. McCammon
Industrial Power Engineer, Public Service Company of Colorado, Denver

WHERE cheap fuel is available and where the necessity of local generation of appreciable heating requirements obtains, the supplying of central-station power service to office buildings, hotels, hospitals and other similar classes of applications has often met with considerable resistance. The extent to which exhaust steam is utilized is often greatly exaggerated in the mind of the owner or operator, who views the problem in the abstract and often holds that during the heating season the electric power generated is a by-product costing practically nothing.

The successful negotiation of central-station service both for new buildings of this class and for existing applications employing isolated generation depends mainly upon how carefully this problem is analyzed and how well the analysis is "sold" to the building owner or operator.

Considerable technical data of great value in the making of these analyses have been published from time to time, and the power engineer or power salesman can afford to give the problem a most comprehensive study, where competitive conditions prevail. However valuable such a study and analysis may be to the trained engineer, it is oftentimes difficult to convince the owner or operator of a building of the truth of a most carefully prepared report unless it is supplemented by actual figures giving the results where similar or parallel conditions obtain. These actual results he can see and understand, and they serve to give confidence, which is the power salesman's most desired objective.

In Denver limitations on building height by ordinance have led to the construction of a number of office buildings of striking similarity in type of construction and general dimensions during the past fifteen years. Records of coal consumption, heating-load curves and electrical load curves of these buildings are a most valuable ally in any new negotiation.


Pounds of Steam
Kilowatt Hours
Time
Heating load
Total electric load
Light load
Surplus exhaust steam wasted, 26,720 lb.
Live steam required for heating 104,720 lb.
Exhaust steam used for heating 25,000 lb.
Elevator load
Total electric load
12 M
1 2 3 4 5 6 7 8 9 10 11 12 N 1 2 3 4 5 6 7 8 9 10 11 12 M

UTILIZATION OF STEAM FOR POWER AND HEATING REQUIREMENTS

Building Data: Eight floors and basement; floor area—six floors, 12,000 sq.ft., two floors, 10,000 sq.ft.; radiation surface, 12,000 sq.ft.; electric load, 120 hp. in elevator motors and lighting.

Estimated Load Curves: Electric load curves are calculated on the basis of exhaust steam available for heating using 60 lb. of steam per kilowatt-hour. Average daily requirements for January: Electric, 862 kw.-hr.; steam, 35,470 lb.

The basic analysis chart of heating-load curve, lighting-load curve and elevator-load curve used in a recent office-building negotiation is shown above. Nearly all the data for this were obtained from a practically identical building utilizing central-station service. The various electrical load curves were imposed upon the steam-heating curves to show the extent of utilization of exhaust steam for heating, the amount of live steam which would be required for heating and the amount of exhaust steam which would be wasted. These data were obtained by a planimeter integration of the areas included by each curve. These curves represent a normal winter-day condition with the mean outside temperature of 38 deg. F., which is the mean temperature for the heating season in this locality. The only assumption made is the conversion unit of 60 lb. of steam per kilowatt-hour, which at first glance seems to be high but has been found by actual observation to be substantially correct.

The results of this analysis reveal a 48 per cent utilization of steam during the heating season of seven and a half months, or an over-all yearly utilization of exhaust steam of $7.5 \times 48 \div 12 = 30$ per cent. With such data it is then a simple matter to calculate the comparative costs of isolated plant generation vs. purchased power.

Saving to Street Railway by Purchasing Power

RECENTLY the Northern Connecticut Light & Power Company, Thompsonville, Conn., began to supply the Hartford & Springfield Street Railway with energy, shutting down the steam plant of the latter at Warehouse Point. The railway company has been in the hands of a receiver for some time, so that a contract for any protracted period could not be obtained. The agreement had to be approved by the courts and is for one year and thereafter from year to year until terminated by either party. The introduction of central station energy into this situation indicates a substantial saving to the transportation company, the rate for energy being on a sliding scale to compensate for diminishing power demands in case the outlying lines are shut down and superseded by buses.

The railway company generated 2,392,000 kw.-hr at Warehouse Point in 1922 at a total cost of $69,950; the principal items were fuel, $46,210, and power station labor, $14,262. Two 500-kw. rotary converters with

the necessary transformer equipment were purchased by the railway to supply the trolley service, energy being purchased at 13,200 volts. The rotary and transformer installation cost about $25,000. Allowing 15 per cent loss in the rotary installation would require the purchase of 2,673,-410 kw.-hr., and at the price paid, including 15 per cent charges on a total investment of $30,000 involved in the supply and $1,000 a year for maintenance, the same amount of power purchased from the Northern Connecticut company would have cost $54,948, or a saving of approximately $15,000 per year to the railway on the 1922 consumption basis.

Accidents Reduced 75 per Cent by Safety Engineering

Comparison of Cost, Number and Severity of Accidents Over Four-Year Period—Methods of Enforcing Safety Rules Employed by the Texas Power & Light Company

ACCIDENT prevention and safety work on the system of the Texas Power & Light Company during the last four years have resulted not only in a remarkable reduction in the number of accidents, but, of still more importance, there has been a marked decrease in their severity and cost. The accompanying tables and chart give a recapitulation of the company's accident record for the four-year period. It will be seen that the total and average cost and the ratio of cost to the total payroll have been reduced in 1923 to less than one-fourth of what they were in 1920.

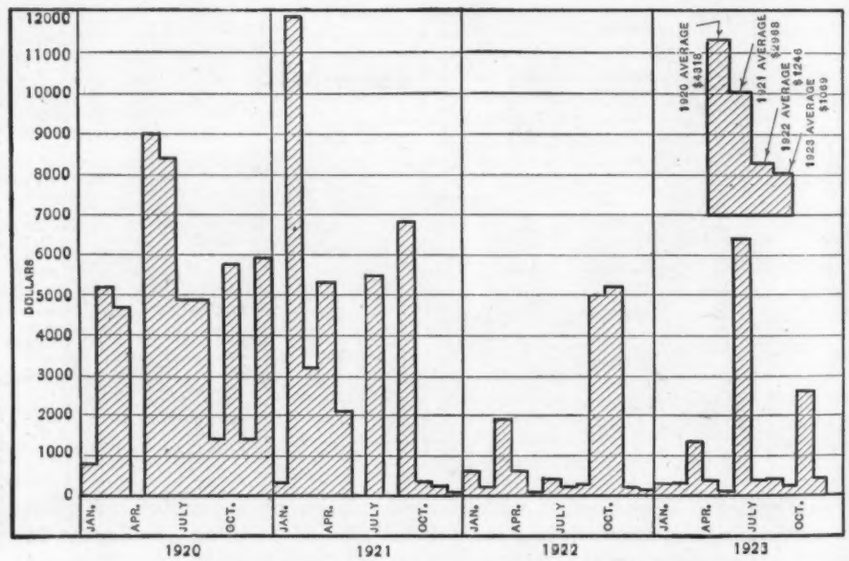
To accomplish these results the company has carried on a continuous educational campaign among employees to encourage the observance of safety regulations. The work has been systematized under the direction of C. J. Rutland, the company's safety engineer, who outlines the essential details of the company's accident prevention activities as follows:

"Experience has taught us that only 5 per cent of the accidents in public utilities may be charged to the management because of failure to install safeguards around dangerous equipment, etc., and that the other 95 per cent is due to the human element, or the lack of responsibility on the part of the injured or his supervisor. Therefore, to be effective in this work we have had to reach all foremen and workmen, not only to solicit their co-operation and their willingness to help individually, but to emphasize the fact to them that an accident does not just happen—there is a reason—and that the things causing accidents are not to be tolerated any more than we would tolerate any other errors or mistakes in construction work or operating practices. With this general propaganda spread broadcast, there is a feeling among all employees that an accident is the last thing that ought to happen in any department.

"The foreman is given to understand that he is charged with the responsibility of accidents in his department, regardless of their nature, unless the investigation shows otherwise. His first duty on taking over a new employee is to teach him the prone-pressure method of resuscitation, issue instructions on the work that he is to do, acquaint him with the hazardous conditions that may surround his work and inform him that under no circumstances will carelessness be tolerated and that he must abide by all rules and instructions.

"Once a month each foreman and each workman serving in a supervisory capacity, whether he be listed as a foreman or not, receives an accident report which shows the relative standing of his department compared with other departments. It covers the number of employees in each department, the number of hours they work, lost-time accidents, days lost, etc. In addition to the statistical value of such a report the psychological effect on the mind of the foreman is of great value.

"Safety meetings in every district are held once every two months. These are employees' meetings and are organized in just about the same way as any other safety meeting might be organized. The educational features of these meetings have been extremely beneficial. Slides of safe and unsafe practices, working conditions, etc., are thrown on the screen and a general discussion is encouraged. This is much more effective



COST OF ACCIDENTS BY MONTHS, 1920 TO 1923

FOUR-YEAR ACCIDENT RECORD OF THE TEXAS POWER & LIGHT COMPANY

Year	1920	1921	1922	1923
Average number of employees	830	750	900	1350
Total number of hours actually worked by all employees	2,100,000	1,930,500	2,316,600	4,643,260
Fatal accidents	7	5	2	*
Number of accidents causing lost time beyond day or shift during which injury was received	123	47	31	70
Number of days lost because of accidents	43,944	30,734	12,524	7,370
Frequency rate—number of accidents per 1,000,000 hours worked	58.6	24.7	12.9	15.0
Severity rate—number of days lost per 1,000 hours worked	20.9	15.9	5.46	1.58

*One accident causing permanent total disability.

COMPARISON BETWEEN TOTAL PAY ROLL AND TOTAL ACCIDENT COSTS

Year	Total Pay Roll	Accident Costs	Ratio of Cost to Pay Roll Per Cent	What Accident Cost Would Have Been on Basis of 1920 Ratio	Net Saving Based on 1920 Ratio
1920	$1,435,378	$51,815	3.60	$51,815	.....
1921	1,312,009	35,617	2.71	47,232	$11,615
1922	1,302,674	14,952	1.15	46,896	31,944
1923	1,578,889	12,838	.81	56,840*	44,002
Total saving in three years					$87,561

*If the ratio in 1923 had been the same in 1920 the total cost of accidents in 1923 would have been $56,840.

than talks and lectures, for that which the workman visualizes he knows. Any new rule, any change of design of construction or any new safe practice put into effect is worked into a slide for use in the safety meetings.

"Three years ago we published a 'safety handbook' and placed one in the hands of each employee. The rules contained are very specific in their nature, and it is made clear just which rules apply to the workman, and then the foreman is responsible for their execution. It is clearly indicated in this book which rules are mandatory and which are recommendatory. Violation of the former is subject to penalty.

"In each meeting an opportunity is given every employee to offer a suggestion or report a hazardous condition or unsafe practice. The handling of these recommendations is devoid of all red tape. A card is made out to cover the recommendation and it is followed by the safety department to completion, whether rejected or approved. Not only has this method eliminated a number of hazardous conditions and unsafe practices, but it has been a medium for acquainting the management with employees' working conditions. Furthermore, it improves the employees' morale because they know that each recommendation they may make, regardless of its nature, is going to receive consideration.

"Four hundred and sixty-five bulletins are distributed throughout the properties and posted in workshops, storerooms, line-gang headquarters, etc., once every fifteen days.

"Every district office has two employee committees — an inspection committee and a prone-pressure committee. It is the duty of the former to make a monthly inspection of all tools, working conditions or any condition in the plant that may be thought hazardous. The prone-pressure committee 'checks up' on each employee every month in each district to see that he is proficient in his knowledge of this method.

"In the company publication there is an accident prevention section which carries reports, suggestions, statistics and other matters of interest to them. This is distributed among the 1,500 employees of the company.

"Every accident involving lost time is investigated to determine the fundamental cause, and such reasons as these are arrived at: Lack of proper instructions, failure to use protective devices, method pursued unsuitable for the work. A few other causes are found which, when determined, immediately suggest a remedy for the prevention of future accidents. Furthermore, this particular classification of accident causes 'pins the ribbon' of responsibility on some individual. Copies of these accident investigation reports are sent throughout the system that all may be duly advised as to which was to blame, the injured or his foreman. This tends to 'put teeth' in our safety work and exerts a psychological weight upon the employee. That these methods have been effective is borne out in the comparison over the last four years, showing a reduction in frequency, severity and cost of accidents to just about one-fourth what they were at the beginning of the period."

New Form of Organization for Northern Illinois

RECENT changes in the departmental set-up of the Public Service Company of Northern Illinois have resulted in the formation of several new departments and some rearrangement of existing departments. Public relations work has been placed in charge of a vice-president, and there has been a reorganization of the activities of the vice-president in charge of sales. An industrial relations department has also been created with a manager in charge. The accompanying chart shows the new form of organization. In an order signed by Samuel Insull, chairman of the board of directors, the changes are given as follows:

1. Creation of the position of vice-president in charge of public relations and service.
2. Transfer of purchasing and stores department activities to the jurisdiction of the vice-president in charge of finance and the establishment of separate purchasing and stores departments. This transfer will have the desirable effect of bringing together under one direction all departments having jurisdiction over moneys, materials and supplies.
3. Creation of an industrial relations department, headed by a manager of industrial relations.
4. Reorganization of the activities under the vice-president in charge of sales.
6. Change of title "district superintendent" to that of "district manager."

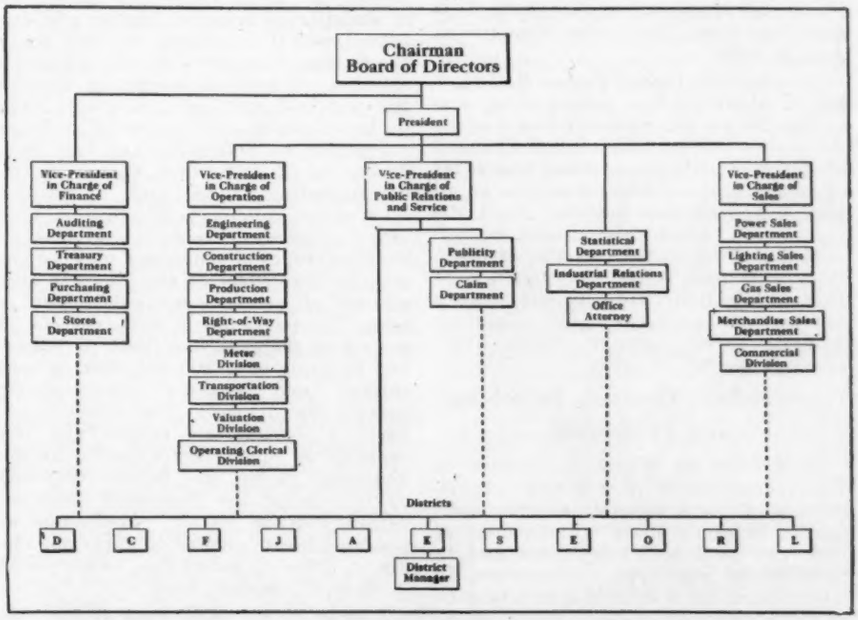


CHART SHOWING NEW ORGANIZATION OF THE FUBLIC SERVICE COMPANY OF NORTHERN ILLINOIS

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Photostat copies or English translations of complete articles will be furnished at cost upon request

Hydro-Electric Development and Steam Equipment

Burning Small Sizes of Anthracite.—A. A. CARY.—The author discusses the firing methods in plants using the small sizes of anthracite coal. The chain-grate stoker is admirably adapted for burning bituminous coal provided the coal is not of the coking variety. With such coal this type of stoker operation follows the coking method of firing.—*Power*, Feb. 26, 1924.

Horizontal-Shaft Francis Turbines.—C. REINDL.—For low-head hydro-electric plants the vertical-shaft type of water turbine is used as a rule. Among the disadvantages claimed for this type are the poor accessibility of the turbine itself and the usual very low speed, requiring expensive generators. Introducing, as has been done in some plants, a gear drive between wheel and generator relieves the latter, but not the former, shortcoming. Three rather unusual stations are described in this paper which employ horizontal-shaft Francis twin waterwheels operating under hydraulic heads of 2½ m. to 7 m. with speeds of 125 r.p.m. to 250 r.p.m. Developing from 800 hp. to 2,000 hp., these sets are suitable for direct coupling to standard generators. An auxiliary offset arrangement of the units in relation to each other reduces considerably the otherwise excessive floor space. A 1,760-hp. hydro-electric unit running at 125 r.p.m. at a head of 4.3 m. measures axially over all 63 ft. The article contains twelve sectional drawings of these three stations, showing the favorable arrangement of such horizontal twin turbines.—*Zeitschrift des Vereines Deutscher Ingenieure*, Feb. 9, 1924.

Burning Oil Under Power Boilers.—R. F. BURKE.—The author first discusses the various types of steam or air atomizing oil burners and mechanical oil burners. He then shows the effect of temperature of the oil on the atomization and efficient burning of oil, the manner in which air should be admitted and regulated and the effect on brick-wall and boiler maintenance of heat localization. He concludes with a number of suggestions for operating oil-fired boilers.—*Power Plant Engineering*, March 15, 1924.

Generation, Control, Switching and Protection

Production of Third Harmonics in Transformers.—S. A. STIGANT.—A discussion of the production of third harmonics in single-phase transformers of both the shell and core types and in three-phase shell-type tranformers, in which cases the magnetic circuit of each phase is complete in itself and no interchange of mmf. and magnetic flux occurs between the phases. With three-phase core-type transformers having three limbs the case is somewhat different as any third harmonic flux tending to flow would have the same instantaneous direction in each limb so that the fluxes must find their return path outside the core through the oil and tank. Such a path has a very high reluctance, and consequently the third harmonic is very small.—*Electrical Times (England)*, Feb. 28, 1924.

Belt-Driven Edison Bipolar Dynamos.—W. S. ANDREWS.—A historical description of Edison's first dynamos, giving in tabular form their design in detail.—*General Electric Review*, March, 1924.

Draft Control and Its Relation to Fuel Expense.—J. T. BEARD.—One of the most important factors in the maintenance of an even distribution of load among the various boiler units, in the economical operation of the individual units and in cutting excessive fuel and power losses in steam generation is the proper control of the draft necessary for burning the coal. Improper control of the air supplied to the fires may result in increased coal consumption, decreased capacity of boilers and high maintenance costs of furnaces. In this article the author considers the effect of stack height on draft, character of fuel bed, what CO_2 readings mean and methods of obtaining and maintaining proper drafts—*Power Plant Engineering*, March 15, 1924.

Transmission, Substations and Distribution

Limitations of Output of a Power System Involving Long Transmission Lines.—E. B. SHAND.—The conditions of stability of a power system are discussed, and it is pointed out that while the various transmission-line diagrams as used at present implicitly assume the terminal voltage at the two ends to be constant, the degree of voltage regulation as determined by load conditions is an important factor in the determination of the limit of output. A type of combined diagram is proposed whereby this factor and other characteristics of the load may be included. The effect of the inherent regulation of synchronous condensers is taken up, particularly with respect to compound transmission lines. A numerical example of a 300-mile line is considered and various characteristic curves are drawn. The relation between the maximum output and the capacity of condensers installed at the mid-point shows the benefit obtained by increasing the condenser capacity within certain limits. Mathematical analyses are presented to cover a number of different conditions.—*Journal of A. I. E. E.*, March, 1924.

Use of Hemp in Uniting High-Voltage Insulators.—W. WEICKER.—Although very reliable cement compositions have been found to hold multi-part high-voltage insulators together, a more elastic combination of these parts may sometimes be advantageous. The old method in which hemp was used in uniting the parts has lately been improved, and its use is recommended in this article. Special long-fiber hemp is wound around the coarse and unglazed threaded part of the porcelain, is ironed smoothly with an ironing machine and is finally soaked with oil, after which the next porcelain part is screwed down tightly upon it, a brake-band operating machine being employed for this operation. Three-part insulators assembled in this way have given good service on lines between 40 kv. and 60 kv. For the voltages considered no danger exists of carbonizing the layers of hemp by internal glow discharges. Any possible weather attack upon the hemp can be safely overcome by a thinly brushed coat of red lead over the exposed edge. Axial pulling tests brought failure of such insulators at between 1,500 lb. and 2,000 lb. Not a small advantage and economy of insulators assembled in this way is the possibility of renewing a broken petticoat without scrapping the undamaged parts.—*Elektrotechnische Zeitschrift, Special Exposition Issue*, 1924.

Units, Measurements and Instruments

Testing Insulators in Service.—PIO G. VENTURINI.—The periodical testing of insulators under operating conditions in the field is most satisfactory from standpoint of cost and efficiency. The author in this article describes what he calls an "acoustic stick," that is, an apparatus developed for testing insulators in service on live lines. He explains how it works, how it must be handled, and, after considering different methods of performing the periodical test, he gives and discusses the results he obtained after four years of experience on a 70-kv. transmission line. Protection to operators and their duty are also treated.—*Elettrotecnica*, Jan. 25, 1924.

Electrically Operated Flow Meter.—R. E. WOOLLEY.—The reasons that gave rise to the development of the electrically operated flow meter are presented in the introduction followed by a general description of the meter. The field of usefulness of the new meter is outlined, and a description is given of the complete device with auxiliaries, the function of its parts and its general principle of operation.—*General Electric Review*, March, 1924.

Methods of Testing Current Transformers.—F. B. SILSBEE.—The author gives a critical discussion of the various possible methods of testing current transformers, with data as to the advantages and disadvantages of each, in order to serve as a guide to the meter engineer in selecting the method best suited to the particular working conditions of accuracy, speed, volume of testing and intelligence of labor existing in his plant. In all, eleven distinct methods are described and supplementary suggestions are made concerning various types of detecting instruments, etc.—*Journal of A. I. E. E.*, March, 1924.

Illumination

Development of the Electric Incandescent Lamp.—B. P. DUDDING and C. J. SMITHELLS.—The authors consider in detail the metallurgical and other properties of tungsten and the difficulties which have been overcome in making this pre-eminent as a material for filaments on account of its high melting point and low vapor pressure. The authors consider the effects of gaseous reaction upon the filament and the action of electrolysis in the glass upon the life of the lamp.—*World Power* (formerly *Beama,*) February, 1924.

Primary Standard of Light.—H. E. IVES.—Measurements of light by a visual method of the brightness of the platinum black body at its melting point are considered. After a description of the apparatus and the methods of making measurements, experimental results are discussed.—*Journal of the Franklin Institute,* March, 1924.

Motors and Control

The Compensated Auto-Synchronous Motor.—ALDO RIGHI.—The author describes an application of the induction motor recently developed by Professor Sartori. The machine consists of an induction motor with wound rotor in which the air gap is so adjusted as to operate as a synchronous machine. The rotor receives the alternating current from the line, the starting compensator being connected to the stator. Another winding is added to the stator and is connected to a commutator by means of regular brushes in which a direct current is allowed to flow as soon as the under-synchronous speed has been reached. This machine permits the automatic increasing of the excitation with the increasing of the load. A power factor of 100 per cent may be maintained with load varying from one-third to the full value. Test data and charts complete the description of this new machine, with industrial applications illustrated and discussed.—*Ingegneria,* December, 1923.

Synchronized Asynchronous Motors.—J. LE MOUNIER and W. WEILER.—These two articles give a theoretical, graphical and constructive description of the recently introduced type of three-phase motor, which operates practically without phase displacement and which is being recommended between the approximate limits of 4 hp. and 75 hp. Electrically this motor is the reverse of the customary induction-motor arrangement in that the line leads are connected to brushes on three collector rings on the rotor, while the ends of the stator phases lead to the starter. On the rotor, and embedded in the same slots is placed a direct-current winding closed in itself and terminating in a commutator. Three brushes per each pair of poles are connected to the stator winding. The motor starts like any ordinary wound-armature induction motor and can be adjusted for any desired starting torque. For equal output it is claimed that the new motor has a slightly higher efficiency and smaller bulk and weight. The motor is not recommended for drives requiring very frequent starting and stopping. Oscillographic records are shown illustrating the relation between line current, secondary current and speed for the starting period. The French article is of a more general character, while the German paper gives very detailed theoretical and practical data.—*Revue Générale de l'Electricité,* Feb. 16, 1924, and *Elektrotechnische Zeitschrift, Special Exposition Issue,* 1924.

Heat Applications and Material Handling

Training Course for Electric Arc Welders.—The American Welding Society committee on the training of operators has analyzed the work of an arc welder and classified the material into the information and training which a successful welder must possess in order to become an efficient workman. The information contained in the article should be of service to those who are responsible for the selection of candidates for training and to the instructor in charge of the training. The instructions are arranged in the following groups: Preliminary practice work, welding steel, welding cast iron, welding copper alloys, carbon arc welding and arc cutting. A consideration of the qualifications requisite to success as a welder indicates that some definite procedure can be set up by which it will be possible to give a degree of assurance that a prospective applicant for training either does or does not possess the necessary qualifications.—*Journal of the American Welding Society,* February, 1924.

Welding Standardization in Locomotive Shops.—J. S. HEATON.—A review of various methods used on boilers, fire boxes and running gear. The article is to be concluded in the April issue.—*Railway Mechanical Engineer,* March, 1924.

Electrophysics, Electrochemistry and Batteries

Magnetic Aging of Iron and Steel.—T. E. GREEN.—Though the subject of magnetic aging is not thoroughly understood, a considerable amount of information has been obtained by various workers in this field of research. This research is divided into two sections—the aging of transformers and similar cores and the aging or maturing of permanent magnets. Tests that have been conducted on the first group are tabulated where the hysteresis loss over five periods up to 1,000 hours is given. A table is also given for permanent magnets in which the hysteresis loss for various steel alloys is shown.—*World Power* (formerly *Beama*), January, 1924.

Distillation of Zinc from Complex Zinc-Lead-Silver Ores.—B. M. O'HARRA and E. S. WHEELER.—The experiments described were undertaken especially to show what results might be expected from the treatment of complex ores by an electrothermic dry distillation process and to furnish data from which might be determined the best manner of conducting the distillation to obtain maximum volatilization of zinc with minimum volatilization of lead and silver. The information is equally applicable to the distillation of similarly briquetted zinc ores in ordinary retorts and, to a certain extent, to the distillation of the usual loose charge.—*Bulletin of School of Mines and Metallurgy, University of Missouri,* Vol. 6, No. 4.

Traction

High-Speed Passenger Locomotive for Paris-Orleans Railway.—W. D. BEARCE.—The outstanding characteristic claimed for the 120-ton, 1,500-volt direct-current locomotives for the Paris-Orleans Railway is its freedom from any tendency toward periodic vibration throughout its entire range of speed. The running gear has two three-axle driving trucks and two-axle guiding trucks at each end. The control and auxiliary equipment is carried in two box cabs. Various tests conducted on these locomotives, mechanical details, electrical equipment, control equipment and auxiliary equipment are discussed. Some of the more important information concerning these electric locomotives is given in the accompanying table.—*General Electric Review,* March, 1924.

FEATURES OF PARIS-ORLEANS LOCOMOTIVES

Rated tractive effort, lb.	18,650
Horsepower	2,820
Diameter of drivers, in.	47.2
Total wheel base, ft.	53½
Width over all, ft.	9½
Length over buffers, ft.	62
Weight on drivers, lb.	169,000
Deadweight per driving axle, lb.	9,064
Total weight, lb.	240,000

Telegraphy, Telephony, Radio and Signals

Telephone Transformers.—W. L. CASPER.—A discussion is presented of the frequency range over which telephone transformers must operate efficiently. The variation of the transformer losses with frequency is studied for various combinations of circuit impedances, and characteristic curves are shown for transformers of different mutual impedances. The mechanical construction of different transformers is described, namely, that of the ordinary battery-supply repeating coil and of three recent types of transformers used principally in various vacuum-tube circuits such as telephone repeaters, carrier frequency and radio circuits.—*Journal of A. T. E. E.,* March, 1924.

German Radio Broadcasting System. E. NESPER.—The main part of this article describes the construction and connection of a crystal receiving set and a one-tube and two-tube radio receiver such as are used by amateurs. The first part of the paper contains a general review of radio conditions in Germany. Radio as an amateur pastime is prohibited, the state permitting and recognizing only regular subscribers to its broadcasting station in Königswusterhausen. This station (Vox-Haus) is controlled by the state, serves the whole of Germany and has been in operation for two months.—*Elektrotechnische Zeitschrift, Special Exposition Issue,* 1924.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Management Fee Reduced

California Commission Deducts Salary of Local Manager from 2½ per Cent Byllesby Charge

AN ORDER has just been issued by the Railroad Commission of California fixing the electric rates of the Western States Gas & Electric Company of Stockton, Cal., and placing them practically on a parity with those of adjoining towns. A complete valuation of the company was made by the engineering department of the commission, and $6,245,000 was fixed as a fair valuation for rate-making purposes. This amount is $1,500,000 less than the valuation claimed by the company. The major items deducted were water rights, estimated by the company at $450,000, and development cost, estimated at $50,000. In deducting development cost the commission takes the position that a utility cannot expect to earn a full return on the investment during the development period of the business. It was shown that during the development period the company had actually earned expenses and 8½ per cent for interest and depreciation.

Perhaps the most important point in the commission's ruling was the partial disallowment of the annual fee of 2½ per cent of the gross revenue to the Byllesby Engineering & Management Corporation. The commission took the position that a fee of 2½ per cent for the services of the holding company was too high in view of the fact that a well-paid general manager is employed locally to manage the property. The commission recognized the value of the services of the holding company, but allowed as an operating charge only 2½ per cent of the gross revenue less the salary of the general manager. This amounts to about 1¼ per cent of the annual gross revenue of the company. It is held by the commission that the measure of the value of the services of the managing corporation cannot properly be expressed as a percentage of the gross revenue, since any increase in rates would increase the amount of this fee without adding in any way to the value of the services rendered by the holding company.

The commission has passed on this point before in the cases of the San Diego company and a small property operating in the central part of the state, both of which are also under the management of the Byllesby corporation. In allowing a charge of this kind as an operating charge the commission recognizes that the managing corporation renders valuable assistance to the local company in the way of helping to finance the property and to purchase material and supplies at an advantageous price and that a central engineering and accounting department renders a useful supervisory and managerial service.

Danger of Power Shortage in California Lessened

General rains throughout the valleys of California with snowfalls in the mountains have decreased the fear of a power shortage due to long-continued drought. Optimistic reports have been received from the special committee appointed to devise measures for conserving power, and the Railroad Commission has postponed from April 1 until May 2 a hearing in San Francisco on the state-wide situation.

The hearing previously conducted in Los Angeles, at which all southern California electric utilities were represented, was reported in the ELECTRICAL WORLD for March 15. Upon his return from that conference A. G. Wishon, vice-president and managing director of the San Joaquin Light & Power Corporation, said that the possibility of a power shortage in the San Joaquin Valley as a result of the drought was so remote that his company would go steadily ahead with its plans for the acquisition of new business. Accurate surveys of all power resources had been made, he said, and there is no likelihood of curtailment.

Initiative Measure to Abolish Oregon Commission

Reports from Oregon say that an initiative bill will be placed before the voters of the state at the November election to abolish the Public Service Commission and to restore all franchises, ordinances, contracts, etc., between public service corporations and municipalities. The act would set aside all "rules, orders, regulations, demands, decisions, powers, privileges and acts" of the Public Service Commission and its predecessor, the Railroad Commission of Oregon, and restore to those officials, municipalities and bodies whose powers were abridged or transferred to the commission all authority, power and privilege as it existed immediately prior to the year 1907, when the Railroad Commission was created. Initiative petitions to place the measure on the ballot have not as yet been circulated. Although abolishment of the commission has been talked of in years past, this is the first instance where an initiative bill has actually been prepared for circulation. It is understood that another bill is being drawn which would abolish the present commission and establish one appointed by the Governor.

To Spend $46,000,000

Penn Public System Puts This as Cost of Clarion and Youghiogheny Developments

THE extensive program of development which has been under way for some time on the part of the Pennsylvania Electric Company, which controls the Penn Public Service Corporation, with headquarters at Johnstown, Pa., and other subsidiaries, and which is undertaking hydro-electric development on the Clarion and Youghiogheny Rivers, will, according to an official announcement made this week, cost ultimately $46,000,000. The plant known as the Piney development, on the Clarion River in Clarion County, Pa., will be ready for operation in June. It was started in 1922 as the smallest of three projects on the Clarion which together will cost $28,000,000.

The other part of the program takes in the Youghiogheny River in Garrett County, Md. There, 2,400 ft. above sea level and "at the top" of the Alleghenies, the first of four dams and three power stations are under construction, at a cost of about $18,000,000. The plants will sell power to the Penn Public System and to other wholesale customers.

Both plants will add a closely connected series of hydro-electric developments to a chain of subsidiary companies operating properties from Maryland across Pennsylvania to New York on the north and Lake Erie and Ohio on the northwest. More than 300 communities of varying sizes and industrial importance are served.

According to officers of the corporation, each of the underlying companies is able to finance its developments through the sale of bonds and stock. They include, among others, the Erie Lighting Company, Warren Light & Power Company, Jefferson Electric Company, Du Bois Electric & Traction Company, Sykesville Electric Light, Heat & Power Company, Big Run Light, Heat & Power Company, and the Venango Public Service Corporation group. All the properties are under the management of H. D. Walbridge & Company of New York.

Erickson Bill to Be Withdrawn in Favor of Bone Bill

Following the contest in the State of Washington between advocates of the Erickson and the Bone referendum bills on municipal power, which it had been decided to submit together to the voters (see ELECTRICAL WORLD, Feb. 9, page 301), Oliver T. Erickson of Seattle, author of the bill bearing his name, has announced that he will withdraw it and

give his support to the Bone bill. Initiative petitions are to be circulated soon to insure a place for this bill at the elections next November, when it will contend with the proposed law embodied in the Reed bill.

As previously reported in the ELECTRICAL WORLD, the Erickson bill provided for the creation of public utility districts with the power to issue general or utility bonds for the purpose of developing and distributing hydro-electric energy, and also for the creation of a state-wide publicly owned power system. The Bone bill, which Mr. Erickson characterizes as "a step in the right direction," gives municipally owned utilities the right to distribute and sell power outside of their corporate limits tax-free and also gives them the right to condemn privately owned utilities outside the municipal boundaries. The Reed bill would impose a tax of 5 per cent on all power sold by municipal utilities outside their corporate limits.

Power Board Activities

Fox River Project Licensed—Permit for Snake River Development—Other Proceedings

LICENSES have been authorized by the Federal Power Commission to cover the following projects: State of Illinois and Fred D. Breit, Fox River, near Dayton, Ill.; Escondido Mutual Water Company, San Luis Rey River, San Diego County, Cal.; Sitka Wharf & Power Company, Medvetcha Creek near Sitka, Alaska; Excelsior Water & Power Company, Yuba River, Nevada County, Cal.; A. E. Humphries, Goose Creek, Mineral County, Col.

The Fox River project is complicated by the fact that the State of Illinois has but limited interest in the site. Mr. Breit will construct and own the project works and lease the state property utilized. Provision is made for the recapture of the project by the state at the end of twenty years. A joint license was authorized. The project of the Escondido company is the enlargement of an existing development. Water is diverted from the river into Bear Valley. The Sitka Wharf project covers those portions of the transmission line which are not in trespass on the National Park on the outskirts of Sitka. The license for the Excelsior company is limited to a period of ten years. There is an opportunity to develop 4,300 hp. of very cheap power by utilizing a short drop from an existing irrigation ditch to the canyon below. The Pacific Gas & Electric Company is to contract for the power. The Humphries project is a small one for mining purposes.

A preliminary permit has been authorized by the commission for the Idaho Power Company covering its project on Snake River at Twin Falls. The Idaho company applied for this permit July 7, 1920. Action has been withheld at the request of the Bureau of Reclamation, which has finally withdrawn its objection.

A year's extension has been granted the Southern Sierras Power Company in connection with its license covering a proposed project on High and other creeks in southern California.

Cumberland Development

Federal Power Commission Permits Insull Interests to Build Three Dams Without Locks

A PRELIMINARY permit has been issued by the Federal Power Commission to the Cumberland Hydro-Electric Power Company of Frankfort, Ky. The conditions of the permit are entirely satisfactory to the company, owing to the fact that the commission did not follow the recommendation of its chief of engineers in requiring the company to provide locks. The Cumberland company is backed by the Insull interests of Chicago.

The preliminary permit covers two proposed power dams in the Cumberland River between Burnside and Williamsburg, Ky., and a third dam in the South Fork of the Cumberland River at a point near Burnside. When this application was filed it was in conflict with the proposed project of the city of Louisville. This application, however, was rejected last year. The three projects will develop 200,000 hp., it is estimated, but it is probable that the immediate installation will not exceed 150,000 hp. Because of the wide variation in the flow of the Cumberland, the engineers of the Federal Power Commission held that the project could be developed only by a company having a large interconnected system and a steam reserve equal to or greater than the capacity of the water-power plants.

The chief of engineers recommended that the applicant be required to construct locks in the dams without expense to the United States. The locks would cost $2,000,000 in each dam. The power company would not consider the project if required to build the locks. The Federal Power Commission was convinced that the power which would be developed could not carry the cost of the locks. Aside from the question of cost, another important consideration is the effect on the storage capacities of the reservoirs of providing through navigation on the pools. The flow of the Cumberland is small during the dry season. The development of power is feasible only if large storage can be utilized. This means that a "drawdown" of from 40 ft. to 60 ft. on each pool must be available. The increased low-water flow below Burnside which will result from the development will improve navigation on the more important portion of the stream.

The preliminary permit contains the condition that the power company is to design its dams so as to permit construction of locks at a later date if found desirable. In that event the cost of the locks will be borne by the United States.

WHITE RIVER DISPUTE GOES ON

The commerce committee of the Senate has authorized a favorable report on Senator Caraway's bill to amend the water-power act so as to allow the Dixie Power Company's expired preliminary permit covering a site on the White River in Arkansas to be extended for another eighteen months. Until the fate of this legislation can be determined no action will be taken by the Federal Power Commission on the application of the Hugh L. Cooper Company. Secretary Merrill has approved the proposed legislation.

Collapse of Boulder Dam Plan Predicted

Testimony of the Federal Power Commission's Members and Chief Engineer Gives Cold Comfort to Backers of Swing-Johnson Bill—Mexican Treaty Needed

FACTS developed at the hearing before the House of Representatives' committee on irrigation of arid lands appear to have undermined the Boulder Canyon proposal to such an extent that the entire collapse of the project is predicted. The advocates of the Swing-Johnson bill got no consolation from the testimony of the three Cabinet officers composing the Federal Power Commission, who were summoned hastily after the receipt of their letter (printed in part last week, page 636), which was in effect an adverse report on the bill and aroused the ire of its advocates. The three Secretaries made it clear to the committee that the attitude of the Federal Power Commission is to urge an adjustment of existing differences so as to allow the development of the Colorado River to begin.

When the Secretaries were on the stand the advocates of the Swing-Johnson bill attempted to get them to assert that no rights on the river would be granted as long as Congress is considering a possible exception to the water-power act in case of a Colorado River development. The Secretaries, however, declined to commit themselves to any such proposition. It was evident from their testimony that rights would be granted immediately on the ratification of the Colorado River compact.

The importance of negotiating a treaty with Mexico has been called to the attention of the State Department, and it is assumed that action will be taken at an early date. The lands tributary to the Colorado on the Mexican side of the border are in great demand. The minute the low-water flow of the river is increased the water will be appropriated. More than a million acres of particularly desirable land in Mexico awaits this development, and the time to negotiate the treaty, it is pointed out, is before appropriation and use become the controlling factor.

Col. William Kelly, the chief engineer of the Federal Power Commission, brought out with particular clearness, in the course of his testimony before the committee, that the Boulder Dam recommended by the Bureau of Reclamation is not the best way to utilize the maximum resources of the Colorado. To build the dam as suggested by the Reclamation Bureau, he pointed out, will mean the ultimate loss of 300,000 hp., while the huge reservoir it will create will result in excess evaporation sufficient to irrigate more than 40,000 acres of land.

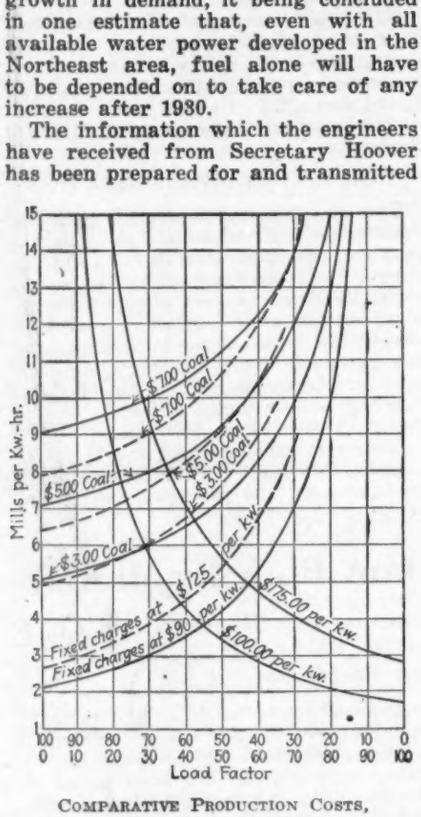
No Northeast Hydro Growth After 1930

Hoover's Engineers Say that Fuel Alone Can Then Be Looked to as the Source of Increased Generating Capacity—Mouth-of-Mine Plants Valued

INFORMATION received by the state engineers in those states being covered by Secretary Hoover's power survey or superpower study indicates that a careful analysis is being made of the intrinsic value of mouth-of-mine steam stations and the practicability of generating large blocks of power at the mines and transmitting it to important load centers. An analysis is also being made as to the extent to which undeveloped hydro-electric power may take care of the anticipated growth in demand, it being concluded in one estimate that, even with all available water power developed in the Northeast area, fuel alone will have to be depended on to take care of any increase after 1930.

The information which the engineers have received from Secretary Hoover has been prepared for and transmitted to him by Colonel Kelly of the Federal Power Commission, and an interesting part of it consists of the two sets of curves shown herewith and the supporting data upon which they are based, as set forth in the captions. It is pointed out in the discussion accompanying this information that considerable judgment must be used in determining various factors which affect all of these curves and the figures, but that they are offered as being in accord with current practice and experience.

In an estimate of the comparative cost of power delivered to centers as against cost of power generated at the centers, Cleveland, Baltimore, Philadelphia, New York and Boston are considered, and, based on the curves reproduced, Table I is obtained. It is then stated: "When in addition the difficulties incident to high-tension transmission are considered, it is safe to say that the local plant will be favored except when a material saving can be shown. Under present conditions it is not likely that power from plants at the mine will be transmitted to distances greater than 200 miles."



COMPARATIVE PRODUCTION COSTS, STEAM AND HYDRO

The group of eight curves pertains to steam plants; the group of two curves (marked $175 per kw. and $100 per kw.) pertains to hydro plants.

The basis on which these curves are calculated is as follows: The steam dotted-line curves are based on a construction cost of new modern high-pressure plants at $125 per kw., with a coal consumption of 1¼ lb. per kilowatt-hour. The steam solid lines are based on construction cost per average plant now producing power at large load centers at $90 per kw., with a coal consumption of 2 lb. per kilowatt-hour. In both cases fixed charges are 14 per cent per annum and maintenance $6 per kw. per year, price of coal $2.50 per ton (2,000 lb.), freight and handling charge for plant at mine 50 cents per ton, storage, handling and insurance at large load center 30 cents per ton, and there is a table of freight rates from which it is possible to calculate the delivered cost of coal at any important center.

The hydro-electric power curves are calculated on St. Lawrence and Niagara power construction costs at $100 per kw. installed and local hydro plant construction cost at $175 per kw. installed, and in both cases with fixed charges of 13 per cent per annum and operation at $2 per kw. per year.

TABLE I—COMPARATIVE COST OF TRANSMITTED AND OF LOCALLY GENERATED POWER

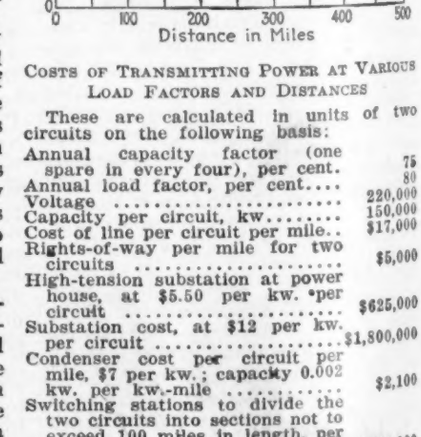
Place	Distance from Mine Plant	Transmission Cost from Mine Plant, Mills	Cost of Power Delivered from Mine, Mills	Cost of Coal, Ton	Cost of Power Locally Generated, Mills	Difference Against Mine Plant, Mills
Mine	...	...	5.6	$3.00	5.6	0.0
Cleveland	125	1.1	6.7	4.80	7.0	—0.3
Baltimore	275	1.8	7.4	5.50	7.45	—0.05
Phila.	350	2.25	7.85	5.50	7.45	+0.4
New York	425	2.7	8.3	5.80	7.7	+0.6

It is then pointed out by the investigators that these figures show the desirability of developing all principal hydro-electric possibilities, but that "the remaining undeveloped water power in the Northeast area about equals the estimated growth of load in that area between now and 1930. In other words, in a few years coal alone will have to be relied upon to supply the increased demand for power."

The information is added that in most large centers a large number of industries are electrifying—either generating their own energy or purchasing it from public utilities. For the so-called superpower region as a whole "the non-electric power has increased by 80 per cent in the last five years. Whereas the kilowatt-hour production of electric railways and public utilities increased 60 per cent (1917-1922), a 'standstill' or decrease is predicted in non-electric power for all fourteen states save Pennsylvania, Massachusetts, Ohio and New Jersey."

TABLE II—TYPICAL ANALYSES OF ASSUMED POWER SUPPLY

	Cost, Mills
BOSTON DISTRICT:	
(Coal $6.70, load factor 38 per cent.)	
All local steam	12.3
Half local steam + sixth local hydro + third St. Lawrence	10.7
Five-sixths local steam + sixth local hydro	12.0
NEW YORK DISTRICT:	
(Coal $5.60, load factor 40 per cent.)	
All local steam	11.1
Two-thirds local steam + third St. Lawrence	9.8
Seven-eighths local steam + eighth local hydro	11.0
Half local steam + half plant-at-mine steam	11.1
PHILADELPHIA DISTRICT:	
(Coal $5.50, load factor 40 per cent)	
All local steam	10.6
One-half local steam + one-half plant-at-mine steam	10.8
Two-thirds local steam + one-third local hydro	9.7
BALTIMORE DISTRICT:	
(Coal $5.50, load factor 40 per cent)	
All local steam	10.8
One-half local steam + one-half plant-at-mine	10.5
Two-thirds local steam + one-third local hydro	9.7
CLEVELAND DISTRICT:	
(Coal $4.80, load factor 40 per cent)	
All local steam	10.1
Half local steam + half plant-at-mine steam	9.5
Two-thirds local steam + one-third Niagara power	9.0



COSTS OF TRANSMITTING POWER AT VARIOUS LOAD FACTORS AND DISTANCES

These are calculated in units of two circuits on the following basis:

Annual capacity factor (one spare in every four), per cent.	75
Annual load factor, per cent.	80
Voltage	220,000
Capacity per circuit, kw.	150,000
Cost of line per circuit per mile	$17,000
Rights-of-way per mile for two circuits	$5,000
High-tension substation at power house, at $5.50 per kw. per circuit	$625,000
Substation cost, at $12 per kw. per circuit	$1,800,000
Condenser cost per circuit per mile, $7 per kw.; capacity 0.002 kw. per kw.-mile	$2,100
Switching stations to divide the two circuits into sections not to exceed 100 miles in length, per station	$250,000
Two circuit telephone lines per mile for two circuits	$1,200
Percentage of transmission lines: 100 miles, 8; 200 miles, 10; 300 miles, 13; 400 miles, 17; 500 miles, 21.	

Hetch Hetchy Effort to Condemn Distribution Lines

The effort of the municipal authorities of San Francisco to condemn the distribution systems in that city of the Pacific Gas & Electric Company and the Great Western Power Company will reach a new stage on July 8, for which date the California Railroad Commission has set a hearing at which the companies named will be required to show cause why condemnation valuations should not be fixed for those portions of the private networks desired by the city as part of its Hetch Hetchy power system. From the Hetch Hetchy water supply and power project San Francisco expects to have 70,000 kw. of energy available in January, 1925, but the city has as yet no means of distributing this expected output.

The board of governors of the Civic League of Improvement Clubs of San Francisco has requested the Board of Supervisors of the city to separate completely the proposals to bond the city for the Hetch Hetchy water system and for a municipal distribution for the hydro-electric power. Under the ordinances as passed the two questions will be put to the voters as one issue.

Birmingham Company Bought by National Power & Light

The Birmingham Railway, Light & Power Company, which has been in receivership since January, 1919, has been purchased by interests affiliated with the National Power & Light Company of New York for $18,500,000. The latter already had a financial interest in the properties at Birmingham, but in acquiring them entirely will be able to take them out of receivership and put them on their feet. The National Power & Light Company is fiscal agent for the Electric Bond & Share Company. The new company will be known as the Birmingham Electric Company.

The Birmingham company was sold at auction, bidders besides the National Power & Light Company interests being the United Gas & Electric Engineering Corporation, also of New York, and the L. S. McEnny Company of Louisville, Ky.

Bondholders' committees have been working with the National Power & Light Company on a reorganization plan. Details of that plan have been agreed upon, and announcement of new financing is expected within two weeks.

Philadelphia Electric Cuts Rates Again

For the third time in three years the Philadelphia Electric Company has announced a substantial reduction in its rates to go into effect on May 1. This cut, the company estimates, will save its consumers $1,300,000, as compared with a saving of $1,080,000 by the reduction of May 1, 1923, and with a saving of $1,200,000 by the reduction of May 1, 1922. The total saving in three years as compared with the bills before the first reduction will thus be more than $7,000,000.

The new residence service rate will be 8 cents per kilowatt-hour for the first 36 kw.-hr. or less, 7 cents for the next 144 kw.-hr. and 3 cents for all electricity used in excess of 180 kw.-hr. during a three-month period. The last step brings a reduction of 2 cents per kilowatt-hour. Similar reductions in the last step of retail lighting service and retail power service are made, the decrease being 1 cent per kilowatt-hour in both blocks. Reductions are also made in the wholesale power service and in various other schedules.

New Jersey Public Service's Rate Reduction

The cuts in rates by means of which the Public Service Gas & Electric Company of New Jersey plans to bring about the $1,500,000 saving to consumers already announced in the ELECTRICAL WORLD have now been filed with the Board of Public Utility Commissioners. For lighting the base rate of 9 cents a kilowatt-hour will be applied only to the first 20 kw.-hr. instead of to 500 kw.-hr. as heretofore. Succeeding steps after the first 20 kw.-hr. a month will be 8 cents, 7 cents, 6 cents and 5 cents instead of the prevailing 9 cents, 8 cents, 7 cents, and 6 cents. The lowest rate begins at 2,500 kw.-hr. a month. Reductions are also made in both retail and wholesale power rates. The new charges take effect May 1.

March Financing Was Accomplished at Lower Rates

PUBLIC sales of electric light and power utility securities by investment houses during the month of March totaled $67,025,000 as compared with $76,184,700 in February and $95,172,750 in March, 1923. Eighteen utilities participated in the month's financing and the largest single offering was the fourteen-million-dollar issue of 6 per cent gold bonds of the Southern California Edison Company, offered at 99 and yielding 6.08. The rate of return yielded the investor, which dropped from 6.52 in January to 6.27 in February, continued on the downward grade in March, when it fell to 6.10 per cent. The financing was for the most part of a long-term nature.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN MARCH

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Nebraska Power Co.	$980,000	..	Cumulative preferred stock	Additions and other corporate purposes	7	98	7.14
City of Tacoma (Elec. Lt. & Pwr. System)*	4,000,000	2-16	Gold bonds, series A	Additions	5½	101.12 to 104.41	5 to 5.15
North Carolina Public Service Co., Inc.	1,365,000	..	Cumulative preferred stock	For purchase of assets of predecessor company		91	7.70
	880,000	20	First lien and refunding mortgage gold bonds, series A		6½	96½	6.80
Wisconsin Public Service Co.	700,000	28	First lien and refunding mortgage gold bonds, series A	To reimburse for construction expenditures	6	97½	6.20
New Hampshire Power Co.	600,000	19	First mortgage gold bonds, series A, sinking fund	Acquisition of properties	6	94½	6.50
Central Indiana Power Co.	6,500,000	3	Collateral gold notes	Extensions and betterments	7	100	7
Central States Electric Corp. (Va.)	4,000,000	5	Secured gold notes	To reimburse for cost of stock pledged as security	7	100	7
Jersey Central Power & Light Corp.	4,250,000	2	Gold notes	To acquire stock and for additions and corporate purposes	6½	98½	7.10
Newfoundland Light & Power Co., Ltd.	1,000,000	25	First mortgage sinking-fund gold bonds, series A		6½	98½	6.60
Wisconsin Securities Co.	1,000,000	5	Collateral trust notes	To retire current indebtedness	6	99½	6.12
Central Power & Light Co.	800,000	28	First lien and refunding gold bonds	Improvements	6½	95	6.90
Florida Public Service Co.	1,350,000	25	First mortgage gold bonds, series A		6½	97½	6.70
Laurentian Hydro-Electric, Ltd.	100,000	9	First mortgage sinking-fund gold bonds	Construction	6½	96½	7.03
Southern California Edison Co.	14,000,000	19	Refunding mortgage gold bonds	Construction	6	99	6.08
Columbia Gas & Elec. Co. (W. Va.)	11,500,000	1	Notes	Acquisition of stock	5	100	5
Duquesne Light Co. (Pa.)	10,000,000	25	First mortgage and collateral trust gold bonds	Additions	5½	99	5.57
Harrisburg Lt. & Pwr. Co. (Pa.)	1,000,000	28	First and refunding mortgage gold bonds	Refunding and corporate purposes	5	95	5.35
Houston Lighting & Pwr. Co. (Tex.)	2,000,000	30	First lien and refunding mortgage gold bonds, series C	To reimburse for extension and for corporate purposes	5½	96½	5.75
Illinois Power & Light Corp.	5,000,000	29	First and refunding mortgage gold bonds, series A		6	98½	6.10
Total	$67,025,000						

*Not included in total; a February issue.

Central Utility Control

B. H. Peck's Paper on This Subject Divides Interest with Range Loads at Chicago Meeting

AN ECONOMIC study of centralized management of utilities versus their operation as isolated units was the subject of one noteworthy paper and the development of electrical range loads was the subject of another at the final Thursday session of the twenty-third annual convention of the Illinois State Electric Association, which was held at the Hotel Sherman, Chicago, March 27.

Bert H. Peck, St. Louis, discussed the centralized management of utilities from two viewpoints, that of the customer and the community and that of the utility, considering under the first head such points as continuity of service, voltage regulation, capacity to serve, extension policy and handling of complaints. Because of the improved service of centrally managed utilities towns containing them were shown to use 18.77 per cent more energy than towns served by isolated plants. From the viewpoint of the utility Mr. Peck pointed out that with centralized management greater diversity factors can be obtained, which would reduce the initial cost per kilowatt-hour. With the construction of large central-station transmission lines the centrally managed company can draw into one power plant a greatly diversified load, thereby bringing about the maximum use of equipment. Then, too, such a utility is in a better position than is an isolated plant to employ high-class engineering talent. The customer-ownership plan is another factor favoring centralized management.

DIVERSITY FACTOR OF RANGE LOADS

C. O. Dunten, manager commercial department, Central Illinois Public Service Company, told how distribution engineers' fears of needed increased transformer capacity vanished when it was learned that the diversity factor of range loads was as high as twelve and fifteen to one. He further declared that the installation on his lines of four thousand ranges rated at 20,000 kw. yielded a yearly income of $180,000 without requiring any increase generator or substation capacity on the distribution lines. The investment necessary to carry range customers averages about $50 per customer.

Adam Gschwindt, Rockford Electric Company, favored the use of demonstrators in promoting the sale of electric ranges, both in schools and in window displays. He thought the objection of the greater expense of electric ranges as compared with other types of cooking could be met by a presentation of facts showing that the elimination of kitchen fumes would save the interior decoration from speedy ruin.

The advantages to utilities of advertising their services more completely to their customers were dealt with by Dana H. Howard, superintendent of advertising for the Commonwealth Edison Company, which during 1923 distributed more than twenty million separate pieces of advertising literature. B. J. Jamieson, engineer Commonwealth Edison Company, told of experiences on his recent European trip. He found a greater use of high-voltage direct-current network than in the United States and a greater use of high-voltage mercury-arc rectifiers for direct-current purposes. In cable design Mr. Jamieson felt that the European engineers were not far behind American specifications.

More than 800 registered for the convention. The election of officers resulted as follows: President, Bert H. Peck, St. Louis; vice-president, J. Paul Clayton, Springfield; secretary and treasurer, R. V. Prather; members of the executive committee, R. F. Wallace of Peoria, H. O. Channon of Quincy, B. J. Denman of Rock Island, E. D. Alexander of Dixon and J. H. Mitchell of East St. Louis.

Wisconsin Code Hearing

The Industrial Commission of Wisconsin and the members of the Electrical Code committee will jointly conduct a public hearing on the proposed changes in the Wisconsin State Electrical Code, at Milwaukee, on April 16. The proposed changes in the code will be printed and one thousand copies will be available at least two weeks previous to the hearing, according to the commission. At this time persons who have other matters to bring up concerning the code which are not listed among the proposed changes will have a hearing.

The above date was selected because the Wisconsin Utilities Association will have its annual meeting during the same week.

Getting Reliable Information on Arch Dams

A site has been selected by the committee appointed by the Engineering Foundation on arch-dam investigation, and a test dam is to be built as soon as sufficient funds have been received to carry on the experiment. The site chosen is on Stevenson Creek, a tributary of the San Joaquin River, about 60 miles east of Fresno, Cal. The site is ideal for the purpose, and it is planned to construct a dam first to a height of 60 ft., making repeated measurements, and later to raise the height in 10-ft. steps to 100 ft. or more and test the dam to destruction. The walls of the canyon are nearly vertical, and it is of such shape that only a few acre-feet of water will be impounded so that no damage will be done when the structure fails.

Subscriptions totaling about $30,000 have been pledged thus far and it is hoped that $100,000 will be raised. Contributors will be privileged to have a representative present during the tests. The design of the dam, the tests and the compilation of all data will be in the hands of the committee appointed for this purpose by the Engineering Foundation. W. A. Brackenridge, senior vice-president of the Southern California Edison Company, will have charge of receiving and disbursing funds.

Water-Power Act Defects

Commission Members Ask Five Amendments and Emphasize Need of Increased Personnel

FIVE amendments to the water-power act are proposed in a bill which has been introduced in the upper house of Congress by Senator Jones, the chairman of the committee on commerce, which has jurisdiction over water-power legislation. These amendments provide that the commission may employ its own personnel rather than borrow employees from the War, Interior and Agricultural Departments, to be paid out of the appropriations of those departments; that the commission shall have sole authority to issue licenses for power developments and to conduct investigations with respect to them; that the commission shall take jurisdiction over permits and licenses issued under legislation prior to the passage of the water-power act; that there shall be made available for administrative expenses the actual moneys collected for that purpose, and that a more complete utilization of lands withdrawn as power-site reserves shall become obligatory.

The bill was introduced at the request of the Federal Power Commission. Secretaries Weeks, Work and Wallace have joined in a statement as to the need of these amendments, from which the following are extracts:

"Owing to inability to employ personnel, the commission has been unable to undertake, except in a very limited degree, certain important duties placed upon it by the act. This is particularly true with respect to the valuation of constructed projects which have been placed under license. There are twenty-three such cases now pending, with an aggregate value claimed of approximately $125,000,000. Since the commission has only two individuals assigned to it who have had adequate experience in work of this character, it is obvious that only a mere beginning could be made. . . .

"The language of the act has been construed to deprive the commission of authority to issue licenses on allotted Indian lands. The result is that when projects involve, as frequently is the case, both public lands and allotted Indian lands, the commission issues a license for the public lands, but authority to use the allotted lands can be secured only by a permit issued by the Department of the Interior. This situation is unsatisfactory from the standpoint of the licensee and of the administration of the act. . . .

"It is still the duty of the individual departments to administer the permits issued by them under the provisions of earlier laws. It is manifest that such a division of responsibility and duplication of administration is undesirable.

"The provision of Section 17 of the act relating to the disposition of receipts is somewhat confused. In order to clarify the provisions of the section and to provide for segregating the moneys collected solely for purposes of reimbursing costs of administration, it is recommended that Section 17 be amended. . . .

"It is recommended that Section 24

of the act be amended so as to permit the Department of the Interior, upon certification of the commission, to restore to full entry lands which the commission certifies have no value for power purposes; to permit lands which have material value for power purposes to be opened in part to location, entry, lease or other disposal, subject to a reservation in favor of the United States, upon the certification by the commission that such action will not interfere with the use of the lands for power purposes, and to permit under appropriate public land laws the temporary leasing of lands which are not required immediately for power development."

THREE AND A HALF YEARS' PROGRESS

The three Secretaries review briefly the results accomplished since the enactment of the water-power act. In that connection they say:

"In the three and one-half years that the federal water-power act has been in force there have been filed with the commission nearly 500 applications for power projects, involving an estimated installation when constructed of 21,500,000 hp., or more than twice the total installed horsepower in existing water-power plants of all kinds in the United States. The commission has issued permits and licenses for 7,500,000 hp., five times as much as had been granted under federal authority prior to the passage of the act. There is 2,400,000 hp. built or building under license of the commission, or nearly twice as much as was built under previous federal legislation in our whole history. The commission has made disposition of 75 per cent of the applications filed. The majority of those—in terms of horsepower—which have not yet been acted upon involve the Colorado and Columbia Rivers and Canadian boundary waters. Delay in these cases has been for reasons beyond the control of the commission."

Loveland, Col., Awards Contract for Municipal Plant

Another step in the fight between the municipal government of Loveland, Col., which has a population of 5,000, and the Public Service Company of Colorado, from whose lines the city has been supplied with electrical energy, has been taken by the City Council, which has signed a contract authorizing the construction of a municipal lighting plant to be in operation by October 18 next. The contract price for a hydro-electric plant and a new distributing system amounted to $371,587, and the construction company will allow the city $83,000 to purchase the distributing system of the Public Service Company provided it is condemned, as proposed by the city.

When the City Council met to open bids on the project a legal representative of the Public Service Company was present and entered a formal protest against the city's proceeding with the work and also warned the bidders of pending litigation.

Loveland first began the erection of a municipal plant in 1917, when work was stopped by a temporary injunction secured by the Denver Gas & Electric Light Company, predecessor of the Public Service Company of Colorado. Later the Supreme Court of the state ruled there was nothing to prevent a municipality from erecting its own lighting plant. Then the Franklin Trust Company of New York, representing a bondholders' protective committee, obtained a further restraining order, and recently the Public Service Company filed a protest with the Public Utilities Commission asserting that the contemplated expenditure by the city was insufficient to erect a plant suitable to its needs and setting forth that adequate service is now being given Loveland by the private company.

Southwestern Division Will Have Balanced Meeting

Merchandising discounts, commercial lighting, transmission-line rights-of-way and financing consumers' extensions are some of the important subjects included in the well-balanced program of the joint convention of the Southwestern Public Service Association and the Southwestern Division, N. E. L. A., to be held at the Hotel Grunewald, New Orleans, April 22-25. General sessions will be held in the morning, while joint sessions will be held in the afternoon. The tentative program is as follows:

TUESDAY, APRIL 22

Addresses by William Pfaff, president of the Association of Commerce, New Orleans, and J. F. Owens, vice-president and general manager Oklahoma Gas & Electric Company; "Prone-Pressure Method of Resuscitation," Samuel H. Reid, Chicago; "Work of the Women's Committee," Miss R. E. McKee, Middle West Utilities Company.

WEDNESDAY, APRIL 23

Morning.—"The Trend Toward Interconnection," M. H. Aylesworth, managing director N. E. L. A.; "Proper Financial Structure of a Public Utility Company," W. C. Lang, Electric Bond & Share Company.

Afternoon.—Accounting Section: "Pay-Roll Standardization," E. C. Jolly, San Antonio; "Classification of Accounts," A. D. Jones, Tulsa; "Purchasing and Storeroom Accounting," J. P. Waite, McAlester, Okla.; "Budget," H. L. Nickerson, Shreveport, La. Commercial Section: "Are Merchandise Discounts Large Enough to Permit a Fair Profit on Selling Conditions?" W. J. Aicklen, Jr., New Orleans; "Domestic Electric Refrigeration," W. E. Clement, New Orleans. Technical Section: "Revised System of Accounting as Affecting the Plant Operator," R. H. Forney, Dallas; "Some Recent Comprehensive Tests on the Fynn-Weichsel Motor," W. A. Layman, St. Louis.

THURSDAY, APRIL 24

Morning.—"National Association and Public Relations," W. H. Johnson, president N. E. L. A.; "Employee Training for Better Public Relations," S. M. Kennedy, vice-president Southern California Edison Company; prize essay, women's committee, Southwestern Geographic Division.

Afternoon.—Accounting Section: "Customers Records' and Billing Methods," W. E. Baker, Pine Bluff, Ark.; "Fixed-Capital Records," W. J. Tharp, Little Rock, Ark.; "Preservation of Records," E. A. Kelley, Wichita Falls, Tex.; "Government Reports and Tax Renditions," A. F. DeLoach, Galveston, Tex. Commercial Section: "Power-Factor Clause in Rate Schedules," W. C. Blair, Dallas; "Commercial Lighting; Possibility of Increasing Central-Station Revenue Through This Source," S. W. Tracick, New Orleans, and J. C. Lamb, Baton Rouge. Technical Section: "Transmission-Line Right-of-Way," Joe E. Ward, Dallas; "Rural-Line Construction," R. F. Danner, Oklahoma City.

FRIDAY, APRIL 25

"Building in the Public Mind the True Conception of Utilities," E. F. Wickwire, Mansfield, Ohio; "Methods of Financing Consumers' Extensions in Outlying Districts," J. R. Irvine, Jacksonville, Fla.; "Complaints on Meter Readings and Changes During the Customers' Absence for Long Periods Without Notifying the Power Company," C. P. Dodson, Decatur, Tex., and Paul Freeman, Calvert, Tex.; "Street Lighting in Small Towns and Villages," W. A. Darter, Giddings Manufacturing Company; "Can the Small Plant Profitably Compete for Power with Gas or Oil Engines?" E. B. Noyes, El Campo, Tex., and G. H. Rolison, Pilot Point, Tex.

Briefer News

Oakland Electric Club Elects Officers.—T. D. Rosenberg was elected president, Herbert Bell vice-president and George J. Duncan secretary-treasurer of the Oakland (Cal.) Electric Club at the annual election recently held.

Projected Hydro-Electric Plant at Logansport, Ind.—The Wabash Hydro-Electric Company has been organized at Indianapolis to build a dam across the Wabash River at Logansport, Ind., and erect a generating station. Application for a preliminary permit has been made to the Federal Power Commission.

Railroad Man to Address Philadelphia Section, A. I. E. E.—"Railroad Electrification—Its Present Development and Future" will be the subject of an address by J. Van Buren Duer of the Pennsylvania Railroad before the Philadelphia Section, A. I. E. E., on April 14. In anticipation of a large attendance, the ballroom of the Bellevue-Stratford Hotel has been engaged for the meeting.

Rhode Island Chapter of I. E. S. Formed.—A Rhode Island chapter of the Illuminating Engineering Society has been formed at Providence with F. W. Bliss, Edison Lamp Works of the General Electric Company, as president and F. C. Eteson, Blackstone Valley Gas & Electric Company, Pawtucket, as secretary and treasurer. F. A. Boss, F. A. Gallagher, Jr., and W. A. Dolbeare were elected members of the executive committee.

Public Service Electric Company's Income Account.—The segregated annual report of the Public Service Corporation of New Jersey for 1923 shows these figures for the Public Service Electric Company, which produced 1,053,906,064 kw.-hr., passing the billion mark for the first time in its history: Operating revenue $31,188,595; operating income after deductions, $9,756,763; net income, $6,742,970; net increase in surplus, $2,207,019.

Construction of Powdered-Fuel Plant at Toronto, Ohio, Progressing.—Construction of the ten-million-dollar steam plant of the Pennsylvania-Ohio Electric Company at Toronto, Ohio, is progressing rapidly. The foundation walls will be ready for the superstructure

about May 1. The first section will contain two 37,500-kva. turbo-generators, the ultimate capacity of the station to be 300,000 kva. Coal will be burned in powdered form. Stevens & Wood, New York City, are the consulting engineers.

Port of Kalama, Wash., Seeks to Acquire Power Sites.—Alternative applications, indicating development of a large hydro-electric plant on the Kalama River in Cowlitz County, Wash., have been received by the state authorities from the port of Kalama. The applications are for different sites and are three in number, the first for 10,386 hp., the second for 23,863 hp. and the third for 16,363 hp., and it is understood that the most feasible site will be selected. Energy developed will be used largely for operating a pulp and paper mill.

More Projected Consolidations in New York State.—The St. Lawrence Transmission Company is seeking authority to take over the hydro-electric plant of the St. Lawrence County Utilities, Inc., at Ogdensburg, N. Y., the authorities of that city offering no opposition. The Empire Gas & Electric Company of Geneva, N. Y., which buys the entire output of the Seneca Power Corporation of Seneca Falls and operates its plant on a fifty-year lease, desires to purchase 12,350 shares of its capital stock, with the intention to bring about a merger.

Central Station with One Customer Asks Leave to Quit.—J. S. Cain has applied to the California Railroad Commission for permission to discontinue electric service in the town of Bodie, Mono County. He recites that in 1915 the population of Bodie was about 150, but that the present population is only twenty, of which only one is a consumer, and that therefore the expense of maintaining the service is greatly in excess of the revenue. He plausibly believes that he should be relieved of his public utility obligations under these conditions.

Site Obtained for New Steam Plant at Marshfield, Ore.—The Mountain States Power Company of Marshfield, Ore., has definitely selected a site on which to erect a seven-hundred-and-fifty-thousand-dollar steam-turbine power plant. The initial installation will be a steam turbo-generator rated at 5,000 kw. The final capacity of the plant, which the company expects to reach in ten years, will be 30,000 kw. The boilers will be equipped to burn mill refuse primarily, but will have facilities for either oil or coal if "hog fuel" is not available at all times.

Merger of Five Pennsylvania Companies.—An application likely to be granted is now before the Public Service Commission of Pennsylvania asking permission for the merger of five electrical companies in York and Lancaster Counties as a preliminary to beginning work on the development of the water power in the southern portion of the state. The consolidated company is to take the name of the Susquehanna Water Power Company, one of those forming it, and will include also the Peach Bottom, Martic, Fulton and Lower Chanceford Township Water Power companies.

Lower Rates for Milwaukee and Other Wisconsin Cities.—A voluntary reduction in electric light rates charged residence, office and store consumers by the Milwaukee Electric Railway & Light Company in Milwaukee, South Milwaukee and Cudahy, and by its subsidiary, the Wisconsin Gas & Electric Company, in Racine and Kenosha, has been approved by the Wisconsin Railroad Commission, effective April 15. In Kenosha the reduction is 9 per cent to the smaller residence consumers and 7 per cent to store and office consumers; in Racine the residence lighting rate has been reduced 10 per cent and the store and office rate 7 per cent, and in Milwaukee the reduction is 1 cent per kilowatt-hour on the first step of residence lighting and $3 per kilowatt-year on the first step of the demand charge of the store and office lighting rates.

Holyoke's New Water-Power Plant.—The Holyoke Water Power Company, having finished the foundations for its overflow hydro-electric plant at the Whiting No. 1 mill, is about to install two 2,000-hp. waterwheels of vertical Francis type. The station structure will be started in May and completed before cold weather. It will be 45 ft. x 110 ft. in dimensions. At the plant on the Connecticut River bank a new 10,000-hp. General Electric steam turbine and a new boiler have just been installed. These installations will bring the company's hydro-electric capacity to approximately 10,000 hp. and its steam-electric capacity to approximately 18,000 hp. An emergency connection recently established with the municipal electric system provides access to a plant service that will have a capacity of 21,000 hp. in steam-electric energy and 1,300 hp. in hydro-electricity before the end of the year.

"Round-Table" Discussions at Spring Meeting of A. E. S.—The "round-table" discussion on refractories for electric furnaces promises to be an important and interesting feature of the Philadelphia meeting of the American Electrochemical Society on April 24-25. The introductory talk will be by Dr. Alfred Stansfield of McGill University, Montreal. The discussion proper will include the viewpoint of the furnace operator, the furnace builder and the refractory manufacturer. Alloy and miscellaneous furnaces will also be reviewed, with a full discussion of brass, steel and non-ferrous furnaces. Other round-table discussions and symposiums will be on electrodeposition and organic electrochemistry.

Program of Wisconsin Utilities Association.—How to improve utility service without increasing its price will be the principal theme of the annual convention of the Wisconsin Utilities Association, to be held in Milwaukee April 17 and 18. Prominent speakers from outside the state include Halford Erickson, M. H. Aylesworth, J. F. Gilchrist, W. S. Vivian, J. W. Hart and S. B. Hood.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

American Institute of Electrical Engineers—Spring convention, Birmingham, Ala., April 7-11. F. L. Hutchinson, 33 West 39th St., New York.

American Society of Civil Engineers—Atlanta, April 9-12.

Middle West Division, N. E. L. A.—Kansas City, Mo., April 9-12. H. M. Davis, Bankers' Life Bldg., Lincoln, Neb.

Missouri Association of Public Utilities—Kansas City, April 10-12. F. D. Beardslee, 315 North 12th St., St. Louis.

Southeastern Water and Light Association—Piedmont Hotel, Atlanta, April 15-17. W. F. Steiglitz, Columbia, S. C.

Wisconsin Utilities Association—Hotel Pfister, Milwaukee, April 17-18. J. N. Cadby, 445 Washington Bldg., Madison.

Southwestern Division, N. E. L. A.—Hotel Grunewald, New Orleans, April 22-25. S. J. Ballinger, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 22-25. E. N. Willis, Dallas, Tex.

American Electrochemical Society—Hotel Bellevue-Stratford, Philadelphia, April 24-26. C. G. Fink, Columbia University, New York.

American Physical Society—Washington, April 25-26.

Rocky Mountain Division, N. E. L. A.—Cheyenne, Wyo., May 5-6. O. A. Weller, 900 15th St., Denver.

Wyoming Utilities Association—Cheyenne, May 5-6. H. C. Chappell, Casper, Wyo.

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

Pacific Coast Electrical Association—Hotel del Coronado, San Diego, Cal., May 17-20.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—Chicago, May 22-23. F. P. Vose, 1347 Marquette Bldg., Chicago.

Electric Power Club—Seaview Golf Club, Absecon, N. J., May 26-29. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Electrical Supply Jobbers' Association—Homestead Hotel, Hot Springs, Va., June 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

Pacific Coast Electrical Association—Hotel Coronado, Coronado, Cal., June 17-20. S. H. Taylor, 527 Rialto Bldg., San Francisco.

American Institute of Electrical Engineers—Annual convention, Edgewater Beach (Chicago), June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Associated Manufacturers of Electrical Supplies—Hotel Ambassador, Atlantic City, N. J., June 24-27. Frederic Nicholas, 30 East 42d St.

Society for the Promotion of Engineering Education—University of Colorado, Boulder, Col., June 25-26. F. L. Bishop, Pittsburgh.

Adolph Kanneberg and Andrew MacDonald, members of the State Railroad Commission; John A. Hoeveler, State Industrial Commission; Richard T. Ely, Edward Bennett, James T. Rood and O. L. Kowalke of the state university will also take part, as will electric utility men from all parts of the state. General sessions will be held in the mornings, and the two afternoon sessions will be devoted to sectional meetings.

Seattle Councilman Suggests Going to Tacoma for Power.—The purchase by Seattle of electricity from Tacoma is suggested by a Seattle councilman as worth investigating before another unit of the Skagit project is undertaken by the larger city. This councilman says that Tacoma will ultimately be supplied with 100,000 additional horsepower at a construction cost of not to exceed $100 a horsepower, and he believes that Seattle could purchase power from the Cushman plant cheaper than it could get it through the Skagit. He estimates that it would cost $750,000 to build a line to link up the Lake Cushman plant with that of Seattle.

Stave Lake Development to Cost Ten Million Dollars.—Final approval of the plans of the British Columbia Electric Railway Company for its Alouette Lake development have been given by the provincial government of British Columbia. A tunnel is to be driven from Alouette Lake to Stave Lake, a distance of 4,000 ft., a dam constructed at the lower end of Alouette Lake and a power house of 11,500 hp. built at the end of the tunnel, using the difference in level of the two lakes of 140 ft. In addition, the present Stave Falls plant, which has a capacity of 52,000 hp., is being enlarged this year by rewinding the present four units and installing a fifth, bringing the capacity up to 70,000 hp. These two projects will be finished by the end of 1925 and will cost $3,250,000. Eventually a third plant at Ruskin, 3½ miles down the Stave River, will be built with a capacity of 96,000 hp. This plant will use the water of Stave Lake twice and of Alouette Lake three times. In all the company will spend $10,000,000.

Progress of Italian Power Company.—After the initial issue of Italian Power Company debentures some months ago (see ELECTRICAL WORLD, October 20, 1923, page 831) the prospect of further operations was temporarily halted by the desire of the Italian Edison Company to finance the electrification of the state railroads when they were turned back to private ownership. The American bankers, it is said, refused to make advances for this project unless such borrowings were secured by a government guaranty. More recently negotiations with Italian interests have been resumed, and the understanding is that they are now prepared to limit the purposes for which the proceeds of loans will be applied to water-power development. On this basis a loan may be effected, especially since the banking syndicate which distributed the initial debenture issue of the Italian Power Company is prepared to handle up to $10,000,000 of such bonds. The aim is to give the loan a maturity of twenty-five to thirty years. Aldred & Company have two engineers on the ground in Italy surveying properties.

Helping the Fish up Dams.—Apparently means have been found whereby the opposition of the fishery interests to the construction of a dam on the Columbia River at Priest Rapids, Wash., on the ground that it would cut off salmon from their spawning ground, can be overcome. The Bureau of Fisheries heretofore has taken the position that fish will not cross a dam more than 30 ft. in height regardless of any fishways built to facilitate their passage. That bureau, however, is said to have revised its opinion as a result of experiments in California where large numbers of fish have crossed dams of greater height. This has been made possible by providing a series of resting pools. This improved method of constructing fishways may be of great significance to the power industry on the West Coast and in Alaska. There are many important rivers on which power dams are being strenuously opposed by those interested in the fish industry. These rivers include the Klamath, the Sacramento and its upper tributaries, the Columbia and numerous smaller streams.

Meeting an Emergency at Winston-Salem, N. C.—Sleet storms in North Carolina are unusual, but one struck Winston-Salem, Reidsville and other places on the lines of the Southern Public Utilities Company a few weeks back which, according to the account just printed in the house magazine of that company, would suffer little by comparison for violence with any ordinary storm of this kind up North. It was, indeed, made worse than these by the fact that the less sturdy trees of the South were the objects of more widespread destruction than is usual in colder latitudes. Transmission and distribution lines were down in all directions, and electric service in Winston-Salem was entirely interrupted during the night of the storm, in spite of everything that the line forces could do to keep the current on. Except for an interruption of forty-five minutes, however, the 100,000-volt service coming into the city stood up well. The company at once put line crews to work with such vigor and efficiency that service was restored in the business district early in the morning. When night fell most of the circuits in all parts of the city had been restored except those for street lighting. In another twenty-four hours a great majority of the customers had service and parts of two street-lighting circuits were connected, and by the third night all of the street-lighting circuits were once more in operation.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

E. D. Kilburn, vice-president and general manager of the Westinghouse Electric International Company, sailed for England on Wednesday, April 2, on board the *Berengaria*.

Anson W. Burchard, president and chairman of the board of the International General Electric Company, sailed on Wednesday, April 2, aboard the *Berengaria* for a short trip to European countries.

Edward J. Nally, managing director of international relations of the Radio Corporation of America, sailed for Europe on Wednesday, April 2, aboard the French liner *Paris*.

E. W. Lloyd, general contract agent of the Commonwealth Edison Company, has left on a trip to Europe and will not be back in Chicago until about the first of June.

James H. McGraw, president of the McGraw-Hill Company, Inc., returned to New York on Friday, March 28, on board the Cunard liner *Berengaria* after spending a month abroad.

George Rivet Van Namee, of Watertown, N. Y., has been appointed a member of the Public Service Commission of New York by Governor Smith to fill the vacancy caused by the resignation of James A. Parsons for the unexpired term of nine years. Mr. Van Namee became a member of the Public Service Commission, Second District, in 1920, upon which he served until the consolidation of the commissions under the Miller administration of 1921. He returned to Albany as secretary to the Governor at the beginning of his second term in 1923 and has held this position until the present time.

Samuel Insull, president of the Commonwealth Edison Company, Chicago, arrived in New York on Friday, March 28, on board the Cunard liner *Berengaria* after a short business trip to England.

John A. Cleveland, district manager of the Consumers' Power Company at Saginaw, Mich., has been transferred to Grand Rapids in the same capacity, succeeding George L. Erwin, who recently retired from that position.

G. E. Beers has succeeded L. R. Lewellen as superintendent for the Iowa Service Company at Hamburg, Iowa.

B. H. Gardner, for the past three years manager of the Lafayette district of the Northern Indiana Gas & Electric Company, has been transferred from Lafayette, Ind., to Hammond to be assistant to the vice-president of the company. Mr. Gardner is still officially connected with the Lafayette property of the utility company, reporting to Vice-president Mulholland

on Lafayette matters. In all matters relating to the northern division of the company, over which he performs general supervisory duties, Mr. Gardner reports to Vice-president Dell Plain of Hammond.

B. H. Peck Heads Illinois Association

Bert H. Peck, manager of the electrical department of the southern division of the Illinois Power & Light Corporation, was elected president of the Illinois State Electric Association at the annual meeting of the association held last week in Chicago. Prior to the organization of the Illinois Power & Light Corporation, Mr. Peck was general manager of the Southern Illinois Light & Power Company, the properties of which are now a part of the Illinois Power & Light Corporation.

B. H. PECK

After a short connection with the engineering department of the Chicago Telephone Company following his graduation from the University of Wisconsin in 1906, he joined the staff of the engineering firm of D. C. & William B. Jackson, where he was engaged on several investigations of national importance, including a complete analysis of the affairs of the Chicago Telephone Company. In 1914 he became telephone expert for the city of Chicago, but subsequently was appointed chief electrical engineer of the Public Utilities Commission of Illinois. While holding this post the Chanut medal was awarded to him by the Western Society of Engineers, of which he has been a member for many years. He resigned from the commission to assume the duties of general manager of the Southern Illinois Light & Power Company. Mr. Peck is a member of the American Institute of Electrical Engineers, the Springfield (Ill.) Engineers' Club and the St. Louis Electric Board of Trade.

O. M. Carter, manager of the Washington Coast Utilities Company at Wenatchee, Wash., for the past two years, has recently been transferred to the Stanwood division of the company.

Walter J. Dennis of the Northwestern Electric Company, Portland, Ore., has recently been appointed assistant to the vice-president and general manager of the company.

W. F. Niblett has been appointed superintendent of operation of the Monongahela-West Penn Public Service Company, succeeding J. C. Donald, who recently resigned.

Frederick L. Farr, formerly identified with Moody's Investors' Service as specialist in public utility securities, has joined the staff of Stevens & Wood, Inc., engineers.

George D. Conley, formerly efficiency engineer with the Fort Smith (Ark.) Light & Traction Company, is now connected with the Oklahoma Gas & Electric Company at Muskogee.

S. E. Boney of Philadelphia has been named by the executive committee of the newly organized North and South Carolina Public Utility Information Bureau as the director of the bureau. Mr. Boney has had eighteen years' experience in newspaper work.

R. L. Weber has joined the electrical division of Stone & Webster, Inc., Boston. For the past ten years Mr. Weber has been engineer for the Kansas City Railways Company and he has also had a wide experience in the design and construction of steam and hydro-electric generating plants.

C. A. Patterson has been made assistant manager of the Central Mexico Light & Power Company, Guanajuato, Mexico. Mr. Patterson has been identified with the electrical industry for several years and was at one time affiliated with the Wichita Falls (Tex.) Electric Company.

Frank M. Reeves, who has been associated for the past four years with the Hawthorne works of the Western Electric Company at Chicago in the capacity of power electrical engineer, has joined the Triumph Electric Company, Cincinnati. Mr. Reeves is a graduate in electrical engineering of the Annapolis Naval Academy.

George L. Erwin, district manager of the Consumers' Power Company at Grand Rapids, Mich., recently relinquished his duties. Mr. Erwin has been associated with these properties since 1898. He was active in the management of the Grand Rapids-Muskegon Power Company and when the properties were taken over by the Consumers' Power Company in 1916 he remained in charge of the company's interests in Grand Rapids as district manager.

Granville Lyons, who for the past year has been manager in charge of the securities department of the Eastern Wisconsin Electric Company at Fond du Lac, has been transferred and made manager of the securities department of the Wisconsin Power, Light & Heat Company at Beaver Dam in connection with the plan of this company to combine its security departments now in Dodge and Fond du Lac Counties under one management with headquarters at Beaver Dam. In his new post Mr. Lyons will be in full charge of the customer-ownership activities of the company in these two counties.

M. E. Skinner Made Commercial Manager of Duquesne Company

M. E. Skinner, assistant to the vice-president of the Duquesne Light Company, Pittsburgh, has been appointed manager of the recently created commercial department of the company. Mr. Skinner entered the service of the Duquesne Light Company in the spring of 1922 as assistant to the general manager and one year later was promoted to be assistant to the vice-president. During his association with the company he has followed actively the design of substations, operation of oil circuit breakers, rate studies, including the application of power-factor-correction clauses, and negotiations for large blocks of power to special industries in the Pittsburgh district. Prior to his connection with the Duquesne company Mr. Skinner spent six years in the transformer design department of the Westinghouse Electric & Manufacturing Company, where he engaged in the design of static induction apparatus, including large power transformers, current-limiting reactors and special equipment of a similar nature. He is a native of Madison, Wis., and a graduate of the University of Wisconsin. Mr. Skinner is an active member of the American Institute of Electrical Engineers, serving at the present time as chairman of the national membership committee and secretary of the Pittsburgh Section. He has contributed a number of articles to the technical press, including several papers presented before the A. I. E. E. on transformer design.

M. E. SKINNER

W. H. McInnis, sales manager of the Keokuk (Iowa) Electric Company, has been transferred to the Nova Scotia Tramways & Power Company, Halifax. Both properties are controlled by Stone & Webster.

John Hood, for many years attached to the San Francisco office of the General Electric Company, was recently appointed manager of that company's new Oakland works in California. Mr. Hood recently represented the General Electric Company in Honolulu.

Commission Rulings

Most Conveniently Located Company to Be Chosen When Competitors' Applications Conflict.—Having to decide between rival applicants for certificates of public convenience and necessity in Asylum and Standing Stone Townships, Bradford County, the Pennsylvania Public Service Commission said: "In these and other similar cases the commission determined that, all other things being equal, the application of the company most conveniently located for the proper development of the territory, as disclosed by the evidence, will be approved."

Right to Issue Stock Without Par Value.—In authorizing mortgages and security issues to effect the reorganization of certain public utility companies the New Jersey Board of Public Utility Commissioners said *in re* Eastern New Jersey Power Company: "This is the first time that the question of the approval or disapproval of no-par common stock has been before this board. After careful consideration the board has come to the conclusion that an electric company formed under the general corporation act, although a public utility, has the right to issue no-par stock; but in order to carry out the purpose of the act the board feels the necessity of stating the value of said stock."

Interrelation Between Maintenance and Retirement Expense. — "Merchandising Net" as Operating Revenue.— In disapproving a proposed schedule of rates submitted by the Idaho Power Company and ordering a new schedule to be filed, the Public Service Commission of Oregon took occasion to commend a provision affecting this company made by the Idaho commission and relating to upkeep expense on the ground that "where many replacements are made through the maintenance accounts it becomes well-nigh impossible to estimate the proper allowance to be made for the retirements charged as such. There apparently is no exact line of definition between maintenance and retirement. Both may be deferred beyond the period wherein they should be charged to the ratepayer. A provision for both as an upkeep allowance based upon the actual experience and history of a series of years removes the foregoing objections and is therefore to be much preferred for regulatory purposes." The provision of the Idaho commission order thus commended is: "For 1923 and each succeeding year thereafter the allowance considered proper for upkeep expense for 1922 should be increased by an amount derived by applying to the average net additions in any account (or, if absolutely necessary, any group of accounts) the actual upkeep percentage (i.e., ratio of the sum of actual maintenance and cost of actual retirements to the average fixed capital) of the five calendar years preceding for the same kind of fixed capital. We believe that this provision for increase, plus the interest accruals on 'retirement expense paid in advance' as set aside in the retirement fund, will provide for an adequate, and no more than an adequate, upkeep expense for a considerable period." The Oregon commission differed from the Idaho commission in holding "merchandising and jobbing, net," to be an operating revenue, thus requiring the addition of nearly $200,000 to working capital.

Recent Court Decisions

Inadequacy of Service Does Not Preclude Increased Rates. — Affirming, in City of Elizabeth vs. Board of Public Utility Commissioners, an order of the board increasing the rates of a water company, the Court of Errors and Appeals of New Jersey said that the failure to render proper and adequate service does not preclude a utility company from applying to the Board of Public Utility Commissioners for an increase in the rates charged, since such inadequate service may be due to insufficiency of rates. The policy of the law is to aid public utilities to function properly and to render adequate service to the public, by permitting rates to be charged for the service rendered which will yield an adequate return upon the capital invested, maintain the property and attract capital. (126 At. 358.)*

Right of Federal Agencies to Conduct "Fishing Expeditions" Denied.— The Federal Trade Commission has no authority to demand all documents and papers from a corporation in an effort to secure evidence of unfair practices, but must confine its demands to such documents as are evidence. This decision was handed down by the United States Supreme Court in a decree which further restricts the commission from so-called "fishing expeditions" into business. The decision, rendered by Justice Holmes, was made in determining appeals of the commission from decisions of United States district courts which sustained objections of the American Tobacco Company to obeying a general order of the commission to produce "all records, contracts, telegrams," etc., in connection with tobacco purchases and sales in 1921. In its decision the Supreme Court said: "The mere facts of carrying on a commerce not confined within state lines and of being organized as a corporation do not make men's affairs public, as those of a railroad company now may be. Any one who respects the spirit as well as the letter of the Fourth Amendment would be loath to believe that Congress intended to authorize one of its subordinate agencies to sweep all our traditions into the fire and to direct fishing expeditions into private papers on the possibility that they may disclose evidences of crime. . . . It is contrary to the first principles of justice to allow a search through all the respondents' records, relevant or irrelevant, in the hope that something will turn up. The right of access given by the statute is to documentary evidence—not to all documents, but to such documents as are evidence. The analogies of the law do not allow the party wanting evidence to call for all documents in order to see if they do not contain it. Some grounds must be shown for supposing that the documents called for do contain it."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Accepting Testimony Not Strictly Within Rules of Evidence Does Not Void Commission Order.—Sustaining an order of the California Railroad Commission fixing rates for a water company (Williamson vs. Commission), the Supreme Court of California said: "Objection has been made to the reception of certain evidence before the commission which, it is claimed, was not legally admissible. Reception of testimony not strictly within the rules of evidence is not of itself a ground for the annulment of an order or decision of the commission. If there is sufficient legal evidence to be found in the record to sustain the commission's order, the requirements of the statute are satisfied. In such a case incompetent or immaterial matter becomes mere surplusage." (222 Pac. 803.)

Maintaining Wires Near Trees Not Negligence per Se, but Facts May Make It So. — Sustaining damages awarded in Morris vs. Jefferson Electric Company for the death from electric shock of a boy who picked up the end of a broken transmission wire lying on or by a path on which he was walking, the Pennsylvania Supreme Court said: "If the only evidence in the record to sustain the verdict was the wire strung close to the limb of the tree the result of whose breaking caused the accident, we would hesitate to sustain appellees' contention. But we do not have simply an accident from a broken wire charged with electricity, or a wire struck by lightning or torn by high winds or some unavoidable cause, or a wire broken down by an unusual sleet storm, or merely the fact that it was close to the limb of a tree. Here we have a No. 6 wire strung on poles from 12 ft. to 13 ft. high, spaced at a distance of 165 ft. The wire was very small for such span; it must carry its own weight and the additional weight of a branch which an ordinary wind might carry against it. As a result of such construction it came in contact with the limb. The constant rubbing of the wire against the swaying branch wore off the insulation, already weather-worn. The obvious thing happened — the wire broke, as it had done before. Had this break been the first, the company might well argue it had no notice; but one, certainly two, of these breaks, with the wire's apparent condition, should have been sufficient to cause the company to replace the wire with one more in keeping with the undertaking. The evidence was not only sufficient for the jury to find a defective wire, but also to charge the company, through its repeated repairs, with express notice of such condition." (123 At. 321.)

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Helping Buyers by Simplifying Varieties

Fifty per Cent Reduction in Their Number Made by Weeding Out Slow-Moving Materials—Sales Were Increased Without Restricting Users' Requirements

By H. B. Wilson
General Manager Mathias Klein & Sons, Chicago

CONSIDER the prospective buyer turning over leaf by leaf several hundred pages of an engineering catalog in a hurried search for some standard type of equipment and delayed by page after page of specialized equipment, until he growls: "Why do manufacturers insist upon playing up their special equipment and tucking their standard equipment away in some corner where no one can possibly find it? Whoever buys this intensely specialized material, anyway? It just fattens up the catalog and makes it difficult to read and locate what you actually desire!" Incidents like this occur daily in virtually every engineering department.

To offset this difficulty and to simplify their own problems and lower distribution costs, many manufacturers are studying what items they can eliminate without restricting the users' requirements. While it has taken some time for the sentiment in favor of the simplification of varieties to percolate through the entire manufacturing industry, the advantage is gradually becoming recognized by both manufacturers and users. Fundamentally the idea is sound, and it might be well to show here what one organization has already accomplished in this way.

Weeding Out Varieties

The first idea of variety simplification started back in the war days, when the government required manufacturers to produce only those commodities for which there was a demand and for which money, labor and materials could be spared. Sentiment remained to warrant further study of opportunities for eliminating excess patterns. The idea has carried along and progress has been made in many lines. This analysis of what has been accomplished by one company during the past six years may perhaps guide other organizations along a similar route for the benefit of both manufacturer and user.

An examination of our linemen's material catalog for 1917 yields a vivid picture of what construction superintendents of that period thought they absolutely needed for the construction of their power and telephone lines. Suppose we dig into a few statistics and ascertain in detail what specialized equipment they required. The first item to come up will be pliers. A close perusal of the 1917 catalog shows thirty-two patterns, ranging from regular standard equipment to a very specialized plier seldom if ever actually necessary. But that is only half the story. These thirty-two patterns were put out in eighty-four various sizes, ranging from 5 in. to 10 in. Imagine looking for a plier in that maze of catalog cuts. And yet this was the situation only six years ago. Today our new 1924 catalog has only thirteen patterns—about a 60 per cent reduction. The number of sizes of these patterns is lowered to twenty-three, or a 70 per cent reduction.

This involved a gradual process of weeding out the slow-moving stock which had been placed in the catalog solely because at some previous time a purchaser had specified this individual piece of equipment. The inexorable law of the "survival of the fittest" was allowed to function with a gentle push overboard administered to some specialized product from time to time which it was necessary to get rid of.

Of course any simplification of variety must take time. It cannot be done completely within a year or two. It was not a case of forcing construction superintendents and users of linemen's equipment to take the equipment we insisted upon their using, but a problem which involved considerable study on our part to determine just what commodity of each line sold the best. It was then merely good business sense to eliminate those commodities for which there was no real demand. The slight resentment on the part of the purchaser toward the idea of purchasing standard equipment when he thought he needed specialized equipment soon passed when he learned that standard equipment could be obtained much more readily and would do the same work.

Temperament in Buying

Not only has this elimination of varieties struck the plier market strongly, but it has also touched other linemen's materials, such as climbers, connectors, wire grips, tree trimmers and knives. It is now amusing to see how "temperamental" linemen were before the war, when they absolutely insisted on specialized equipment. That period shows six different types of climbers calling for such oddities in specifications as a punched or riveted strap loop, various weights and different types for inspectors who climb poles only occasionally. Today one type of climber serves the entire utility industry. What is there to be said further on the subject when within a period of six years such an end can be accomplished?

And so it was on down through the entire list of materials offered to linemen. Connectors, which crowded the catalog to the number of sixteen back in 1917, now number only six. Wire grips totaled twenty-two patterns in fifty sizes in 1917; today five patterns and twelve sizes serve the same purpose, a reduction in patterns of 72 per cent and in sizes of 56 per cent. Thus simplification was carried on throughout all lines until a count of patterns of all the commodities listed in our 1924 catalog numbered only seventy-two items,

compared with 150 in 1917 (a reduction of more than 50 per cent), with a corresponding reduction in stock investment and production facilities required.

ADVANTAGES TO MANUFACTURER

The advantages of such reductions affect three members of the distribution triangle—the manufacturer, his jobber or distributor and the ultimate consumer. By virtue of simplification the manufacturer is not required to bear such a large development expense without the assurance that an investment in tools, dies and manufacturing space will prove profitable. By concentrating on the fewer commodities which do have a large demand and by eliminating the "weak sisters" larger production and better deliveries can be effected. Less scattered effort on non-revenue-producing commodities will also automatically improve manufacturing conditions on standard lines. These advantages are reflected in prices and deliveries to the consumers.

For these reasons educational work by manufacturers on variety simplification can well be considered a part of engineering development expense, because in the end the manufacturer does benefit and is in a better position to pass these benefits on to his distributors and consumers. Our own experience has been that we have been able to avoid increasing prices in spite of the tremendous climb in the cost of labor. The increased production and the proportional increase in sales of a smaller number of items have proved that the idea is correct.

From the jobber or distributor who handles a simplified line of manufacture come other favorable reactions. No longer does this jobber or distributor need to exercise such vigilance in selecting equipment for which there will be a good call. The problem of determining those commodities which will sell the best does not confront him with the same intensity as it did formerly. With simplified standard equipment he can be fairly sure that his stock will turn over at a rate not obtainable with specialized equipment. No longer does he need to gamble as to what equipment he must buy.

Furthermore, as a result of simplification of varieties the distributor can with a much lower total investment carry a larger stock which will meet any normal demand. An interesting example of this can be seen through a comparison of emergency rush orders sent in to the factory during winter sleet storms of recent and former years. During the severe storm last January the number of rush orders sent direct to the factory was nowhere near the volume usually sent before the war during such periods. In the past it was a common practice for us to be prepared to ship on a moment's notice to jobbers in storm-ridden territories. Whether the present small number of emergency orders during storms can be interpreted as a direct result of a variety simplification is hard to determine. However, we do know that jobbers are maintaining better stocks and are in a better position to give users improved service because of their quicker turnover of standard equipment.

To the ultimate consumer variety simplification means quite as much as to the other two classes mentioned. A comparison of present-day prices with those existing in 1917, before the thought of simplification existed, shows that a reduction of approximately 25 per cent was effected by this simplification-of-varieties program, which of course interests the user favorably. Deliveries from distributors have also been improved because they now know exactly what lines to carry. Besides obtaining better prices and improved service from distributors, the purchaser's time and patience are no longer taxed in going through an unwieldy catalog. It is this consumer that the manufacturer must please with his service if he expects to prosper in his business. Variety simplification does improve this service, as our experience proves very conclusively.

Trade Associations Should Continue Statistics

THE essentiality of the trade association and of trade statistics was pointed out in a recent address by Nathan B. Williams, associate counsel of the National Association of Manufacturers, as follows:

"Trade associations are tools of industry. They are, of course, like all tools, subject to misuse. The trade association is the primary source for accurate information respecting a particular industry or trade, the legitimate, the obvious and the fundamental agency, to gather, prepare and disseminate this information.

"The collection and publication of unidentified current trade statistics is not unlawful. My judgment and my advice is that legitimate trade associations continue their statistical and other activities without reference to the correspondence between the Attorney-General and the Secretary of Commerce; that in conducting their activities they be careful not to transgress the well-known inhibitions of existing law, in that they shall not misuse their statistical and other trade information in promotion and furtherance of any agreement or conspiracy to fix prices, limit production, restrict sales, divide territory, or otherwise restrain lawful competition in commerce."

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

A LITTLE more life is in evidence in the electrical industry this week, and the general tone of the market continues steady and strong but without any conspicuous activity. Jobbers throughout the country report that business so far this year is fully up to last season, which was nearest to normal of any year for some time. There seems to be no clear promise of any early increase in demand. Buying by the retail trade and the consumer continues conservative. On the other hand, the jobber is actively maintaining his stock, with perhaps a tendency to increase his stock investment. It is questioned, in view of the constancy of the market and the effect upon the public mind of the disturbances in Washington, whether the spring boom of last year is to be repeated.

In the New England district, although the textile and leather industries are dull, the electrical business in general is steady and appliance sales are reported as being 25 per cent above a year ago. There has been a noticeable improvement in industrial buying in the New York district, while demand from utility companies continues active and business among the jobbers is considered fairly good. In the Southeast a brisk improvement in business is reported, which is of interest, coming as it does after a sluggish period of several weeks. Central-station construction continues in the Middle West, and several very active lighting campaigns are in progress. Appliance sales are good and a large amount of business has been booked by wire manufacturers. On the Pacific

Coast business is generally quiet, except in the Northwest, where appliances are active.

Fuse Demand Shows Slight Gain —Keen Competition Still Exists

SALES of fuses have remained approximately the same as they were about six months ago, the increase in demand being comparatively small, probably owing to industrial inactivity. However, although no spectacular orders have been received, a better tone is now evident in the market. Sales are rather spotty, but the outlook is declared good and distributors are meeting the calls of the local trade promptly. The expansion of the building industry and the enormous development of central-station service have been prominent factors in the business.

Considerable dissatisfaction is voiced by manufacturers in regard to the general condition of the non-renewable fuse industry. For several years back unscrupulous price competition has destroyed this business as a profitable line of endeavor, and it is very hard to say what the final result will be. Certainly there are many more manufacturers than the demand would warrant. It has been declared in more than one instance that the margin between selling price and cost is too low viewed from the manufacturer's angle —a situation that apparently has prevailed for a considerable period. Raw material and labor are plentiful, and the open winter has been most favorable to transportation.

The demand for renewable fuses has been showing a slight gain and is considered fair at the present time. The bulk of the fuse business, however, still appears to be in non-renewable fuses, this being due undoubtedly to their lower first cost. Immediate deliveries can be made on renewable fuses and stocks are good. The demand appears to be almost entirely a question of selling service and the education of the user to its value. Prices in general have not changed, although one of the manufacturers of non-renewable fuses recently quoted some very low prices for a few days. These prices have since been withdrawn. No price changes are expected at least within the next six months.

Demand for Refrigerating Equipment Becoming Less Seasonal

FROM a highly seasonal business the manufacture and sale of electrically driven refrigerating apparatus is gradually taking on "year-round" characteristics, with resulting benefits to both producer and consumer. The major development in the business continues to be for commercial application, but the outlook is excellent for a wider use of residential equipment during the year.

In the past few weeks a much better tone has been apparent in the market, but it is questionable if sales thus far in 1924 are more than 85 or 90 per cent of those of a year ago. Shipments from a representative factory, however, are running about 10 per cent ahead, as back orders are worked up.

The outlook for business is encouraging, considering the rapid progress being made in the design and manufacture of improved types of machinery for residential use. The sale of cheap machines on long-term agreements and the financial difficulties of one or two concerns not well established as to patent conditions, experience in this highly technical field and other conditions have caused some disturbance in the market, but concerns selling refrigerating plants for commercial service only after thorough study of the requirements in each case are confident that 1924 will witness increased stabilization of sales conditions.

The most popular size of commercial machine moving, according to a leading maker, is the 4-ton unit. Deliveries were never better, raw materials are in ample supply and factory labor is plentiful. Prices are steady. The market is most active in New York and New England, but there is a steady growth of business apparent in the South, where the value of food storage is beginning to be appreciated more and more.

Central-station co-operation, according to well-informed opinion, is sluggish in some sections, the interest of certain utilities in securing a merchandising profit on the sale of cheap equipment hampering the cultivation of high-grade business.

Demand for Dry Cells Constantly Increasing

THE demand for dry cells at the present time is reported by all manufacturers as being particularly good. While radio has been a very important factor in creating a healthy demand, there has been and still continues a constantly increasing use of dry cells in machinery equipment, motorboats, farm engines, miscellaneous ignition, etc. It is very hard to determine accurately just what ultimate use is made of the dry cell, but reasonable estimates show that for telephone use and for heat regulation the demand is remaining practically constant, while for doorbell, office and household use there is probably a decline in consumption due to the increasing use of transformers. For all other uses the demand is estimated to show an increase of from 7 per cent to 20 per cent, with the exception of radio, which is expected to show an increase of from three to four times over 1923. The recent announcement of the Radio Corporation of America covering its complete new line of sets, all of which are equipped with dry-cell tubes, will naturally play its part in stimulating the demand. The dry cell in most popular use is the 6-in. cell.

Flashlights are in steadily increasing demand, which is attributed in no small

VALUE OF ELECTRICAL EXPORTS FOR FEBRUARY, 1924, COMPARED WITH CORRESPONDING MONTH IN 1923

	February 1923	February 1924
Generators:		
Direct-current:		
Under 500 kw.	$64,319	$77,453
500 kw. and over	111,117	13,714
Alternating-current:		
Under 2,000 kva.	23,776	19,125
2,000 kva. and over	102,946	161,012
Steam-turbine generator sets	*	784
Accessories and parts for generators	20,523	58,930
Self-contained lighting outfits	25,962	54,850
Batteries:		
Flashlight	*	58,595
Other primary	98,073	62,564
Storage	182,454	240,090
Power transformers	280,135	214,342
Other transformers	38,200	263,071
Rectifiers, motor-generators, dynamotors, synchronous and other converters	17,375	74,448
Switchboard panels, except telephones	68,481	113,954
Switches and circuit breakers over 10 amp	127,942	118,323
Fuses and fuse blocks	19,261	30,223
Watt-hour and other measuring meters	19,962	91,493
Volt, watt and ampere meters and other recording, indicating and testing apparatus	79,258	103,462
Lightning arresters, choke coils, reactors and other protective devices	58,278	80,784
Motors under 1 hp.	117,076	133,846
Stationary motors:		
1 hp. to 200 hp.	185,706	271,043
Over 200 hp.	104,195	37,210
Railway motors	13,167	136,011
Electric locomotives:		
Railway	.....	.....
Mining and industrial	4,620	47,350
Other motors	30,238	†
Starting and controlling equipment:		
Industrial motors	*	123,183
Electric railway and vehicle	*	23,157
Rheostats, controllers and other starting and controlling equipment	72,661	†
Accessories and parts for motors	83,899	162,832
Electric fans	122,725	166,880
Electric lamps:		
Incandescent—		
Carbon-filament	1,141	6,286
Metal-filament	89,043	75,020
Other electric lamps	$17,260	$29,488
Flashlights	29,391	53,945
Searchlights and projectors	49,522	40,155
Motor-driven household devices	64,003	72,091
Domestic heating and cooking devices	73,716	84,521
Industrial electric furnaces and ovens	5,616	13,552
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries	50,385	90,383
Radio and wireless apparatus	174,127	302,121
Telegraph apparatus	37,734	73,551
Telephone apparatus	.....	.....
Magneto telephones	5,544	6,566
Other telephones	14,875	83,218
Magneto switchboards	5,156	3,880
Other telephone switchboards	50,690	89,412
Other telephone equipment	*	141,615
Railway signals, switches and attachments	109,427	193,610
Bells, buzzers, annunciators and alarms	6,454	8,945
Spark plugs, magnetos and other ignition apparatus	64,783	178,175
Insulating material	95,118	187,701
Metal conduit, outlet and switchboxes	32,058	54,121
Sockets, receptacles and lighting switches	76,503	92,469
Other wiring supplies and fixtures	115,671	†
Electric lighting fixtures, interior and street	*	68,832
Other wiring supplies and line material	*	89,750
Other electric apparatus, not elsewhere specified	679,311	720,416
Globes and shades for lighting fixtures	38,927	26,710
Electrical glassware, except for lighting	14,160	28,273
Electrical porcelain	145,912	158,061
Electrical carbons, carbon brushes, electrodes	103,877	213,576
Insulated wire and cable (iron and steel)	40,686	50,890
Other manufactures of aluminum	44,673	56,725
Copper:		
Bare wire	125,606	130,771
Insulated wires and cables	211,886	463,234
Total electrical machinery and apparatus and supplies	$4,645,614	$6,826,792

*Not separately stated prior to January 1, 1924. †Discontinued beginning January 1, 1924.

measure to standardization of types and to the fact that the flashlight has passed from the toy stage to that of a staple. Where formally there were a number of styles and types, there are now only two standard size dry cells used in flashlights, while many other improvements, such as the new-type switch, the focusing light, etc., have been made.

Manufacturers are now preparing for the spring sales campaigns, when large sales of dry cells are usually made, and are in an excellent position to make deliveries. It is stated that there are sufficient facilities to meet the expected demand. Prices are stable and no changes are expected.

New England Trade Is Steady

THE ups and downs of the textile and leather industries are apparently having little serious effect on the sale of electrical supplies in New England as a whole, according to statements of leading Boston jobbers. Meanwhile a very large volume of trade is being handled in connection with central-station expansion, the metal-working industries and the wiring and fixture equipment of buildings. Appliance sales in representative retail stores are running at least 25 per cent above a year ago.

The purchasing of motors is fairly active, and a leading group of central stations reports an average of 10 per cent more power sales output than a year ago. With the exception of radio tubes, tubes for small rectifiers and storage batteries for radio service, deliveries are easily meeting the current demand. Stocks are being replenished on a conservative buying basis, and the accumulation of weatherproof wire has begun to set in motion rumors of a possible weakness in prices to be expected in the next two or three weeks. Price readjustments are in process on galvanized pole-line hardware and flexible duct for hard service.

Customers of electrical supply jobbers in the New England district are responding well to their credit obligations as the spring business gets under way. A fair average for jobbers' collections is between fifty-five and sixty days.

Industrial Buying Better in New York District

ELECTRICAL men in the New York district report a distinctly noticeable general betterment in several industries. Inquiries have increased and more orders are being placed by industrials as a whole. The demand for fractional-horsepower motors is particularly good. Deliveries are about the same on industrial apparatus, with slight improvement shown in some cases.

Utility companies continue active, much transmission-line work being planned and under way. One manufacturer has just announced a decrease in the price of brass and copper products, this decrease offsetting the increase made within the past eight weeks.

In the jobbing industry business was fairly good this week and although radio sales have shown the seasonal falling off, they are better than this time last year. General supply lines are moving slowly and competition remains particularly keen in this line of the business. Stocks in general are very good, as with comparatively low markets jobbers have been actively buying. Dealers' stocks are light, however, so that it is believed that a better demand will open up with the spring trade. Except in scattered instances, manufacturers' stocks are generally in good shape.

Business Shows Brisk Improvement in Southeast District

RETAIL business, generally sluggish for several weeks in the Southeast district, has opened with a rush during the first week of spring weather and extraordinary sales efforts are being made. Employment generally is satisfactory, though some of the cotton mills are on part time operation. The Southern Railway announces the construction of additional yard facilities for Atlanta amounting to a capacity for 500 cars, this being a striking indication of the freight handled in this section.

Recent changes in the electrical codes of various Southeastern cities have begun to cause a brisk movement of armored conductor and are slowing up porcelain lines, with the exception of insulators. Sales of the latter item, like those of line hardware, are good. The fan season is opening up satisfactorily and good orders are reported by jobbers. The small shipments that radio manufacturers are making on the new models have completely upset jobbers. The dealers insist on the new equipment and the jobbers are unable even to begin to meet the requirements. The leading jobber of radio supplies in this section states that his business is approximately 30 per cent over last year and that prospects are that the demand will be sustained through the summer, if the manufacturers will furnish the equipment.

Construction and Lighting Campaigns Active in Middle West

CENTRAL-STATION construction continues an important factor in the Middle West territory. Pole-line hardware demand is good and the general program of central-station expansion is moving forward as fast as procurement of equipment permits. Inclement weather conditions have somewhat retarded building construction.

While business in the electrical trade continues on a satisfactory and optimistic basis, there is evidence of caution with regard to the placing of large commitments. Appliance sales have been good with washing machines and vacuum cleaners in the lead. Extensive campaigns by a large utility on better lighting for stores have resulted in a large volume of business in this particular field. An active campaign for better kitchen lighting, inaugurated last week, has also resulted in stimulated trade.

A considerable amount of business was booked by wire manufacturers, and jobbers have been requested to quote on several large specifications this week. One manufacturer reduced the prices of some lamp cords, but this is considered a revision rather than a price reduction as the former prices were not strictly competitive.

Business Still Quiet on the Pacific Coast

ELECTRICAL business continues light on the Pacific Coast. Government ordering is not active, the demand from the railroads is quiet, power companies are not buying, and there is a distinct lull in contracting. There are many large buildings that will soon be ready for roughing-in materials, however, which is expected to bring a stimulus. Considerable central-station activity is expected from the efforts of the Coast companies to prepare for fall emergencies in case of reservoir depletion—the Sacramento steam auxiliary plant of the Pacific Gas & Electric Company is being rushed, and the southern California power companies are already purchasing from northern California.

There were price advances of 5 per cent on non-metallic flexible conduit and about 10 per cent on glass insulators during the week. Motor sales continue excellent. Lamp sales and other business dependent upon illumination have been reduced noticeably by the absence of the usual number of dark winter days on the Coast this season. Appliances and household wiring devices are particularly active in the Seattle territory, and the better class of fixtures is in increasing demand. Various campaigns featuring different devices are being actively waged in the Mountain region. Collections are good, however, and it is generally expected that 1924 is to be a good year in the electrical business in the Far West.

The Metal Market

THERE has been little activity in the non-ferrous metal market during the week, recent declines in London producing most cautious and conservative buying by consumers. Reduced prices made by some of the producers last week have had little effect in stimulating demand. The slight gain in prices in the last two or three days has been occasioned by the improvement in London and not by any better demand.

NEW YORK METAL MARKET PRICES

	Mar. 26, 1924 Cents per Pound	April 2, 1924 Cents per Pound
Copper, electrolytic	13¼	13¼–13⅜
Lead, Am. S. & R. price	9.00	9.00
Antimony	12	10½–11
Nickel, ingot	26	26
Zinc, spot	6.65–6.70	6¼
Tin, straits	51	51¼
Aluminum, 98 to 99 per cent	27¼	28–29

Offerings of lead have been made freely, particularly in the last few days, at prices below that asked by the leading interest, but consumers are not much concerned as apparently they have sufficient lead to meet present requirements and are willing to wait before making further commitments in the hope that the price will decline further.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Habirshaw Cable Company Expecting Profitable Year

In a letter sent to the creditors, Randolph Whitman, chairman of the creditors' committee of the Habirshaw Electric Cable Companies, has announced that it has just been decided that there will be no sale of the properties for reorganization before the middle of the summer and possibly not until later than that.

In the meantime the company keeps on making money and putting itself in a position to pay off the creditors. The operating profits for the first two months of 1924 were $133,816, which compares favorably with 1923, the record year. On the basis of business done in March the operating profits for this month are expected to be large. Unfilled orders and additional business which is virtually assured point to a highly prosperous year. Assets available for the creditors on March 1, 1924, amounted to $4,970,550.

Western Electric Company Offers Debenture Bonds

The Western Electric Company is now offering through a banking group headed by J. P. Morgan & Company an issue of $35,000,000 of twenty-year 5 per cent debenture bonds at 96½, to yield more than 5.25 per cent. The proceeds are to be used to take care of the company's business, to provide additional working capital, and specifically in connection with the construction of a manufacturing plant at Kearny, N. J.

Otis Elevator Company to Vote on Increase of Common Stock

The twenty-fifth annual report of the Otis Elevator Company shows that earnings for the year ended December 31, 1923, after deducting allowances for depreciation, charges for patent expense, renewals and repairs for maintenance of plant and equipment, were $4,008,705. Reserves of $1,025,000 set aside for federal taxes, pension fund and contingencies leave a net income of $2,983,705. With preferred dividends of $390,000 paid during the year and $1,000,000 set aside as additional reserve for working capital, there remains a balance to undivided profits of $1,593,705. By deducting dividends on common stock paid or declared as of 1923 and adding the undivided profits account of December 31, 1922, there is left for undivided profits account of December 31, 1923, $1,702,439.

A meeting of shareholders is to be held April 28 to vote on a proposal to increase the common stock from $15,000,000 to $25,000,000 and to reduce the par value from $100 to $50. If the reduction in par value is approved, the present shares will be exchanged in the ratio of one for two. At present there are outstanding 142,278 shares of an authorized issue of 150,000 shares of a par value of $100. All of the $6,500,000 preferred stock is outstanding.

Rome Wire to Move Stamford Plant to Rome

The Rome Wire Company, Rome, N. Y., has sold the land and buildings of the Atlantic Insulated Wire & Cable Company to the Atlas Powder Company and will bring the machinery to Rome during the coming summer to carry on there the manufacture of Atlantic wires and cables. The necessary additions required at the Rome plant will be put under way at once.

The Rome company purchased all of the capital stock of the Atlantic company in 1922, and since that time the plant has been operated under its former management, the present employees numbering about two hundred. Since the absorption practically all the copper wire used by the Atlantic company has been manufactured by the Rome company.

Westinghouse Income Increases

The Westinghouse Electric & Manufacturing Company in a report to the New York Stock Exchange covering the ten months ended January 31, 1924, shows gross income of $127,351,096 against $125,166,115 for the full year ended March 31, 1923. In the ten-months period the net income amounted to $14,539,845 available for dividends against $12,263,485 in the previous full year. The largest previous net income occurred in 1917, when it exceeded $18,000,000.

Canadian General Electric Company Has Good Year

The report of the Canadian General Electric for the year ended December 31, 1923, just made available, shows a net profit of $678,083, after interest and depreciation, compared with $104,564 in 1922 and $706,092 in 1921. The offer of the American General Electric to old common stockholders of the Canadian Company has been accepted by over 90 per cent of the outstanding stock, according to A. E. Dyment, president.

Mr. Dyment further said that, having in mind the possible expansion of the electrical industry in Canada, it was probable that for some time to come it will be prudent for his company to conserve its cash resources and use its surplus earnings, after payment of dividends on the preferred stock, to provide for extensions of manufacturing facilities, rather than for the payment of dividends on the common stock.

Simplex Wire & Cable Company Expands Facilities

The Simplex Wire & Cable Company, Boston, is enlarging its facilities for the manufacture of paper-insulated cable, a new four-story building with about 40,000 sq.ft. of floor area having been assigned to this class of production. Increased storage space is also being set aside, and in the near future the company will enlarge research laboratory facilities at its Cambridge factory, about 8,000 sq.ft. being available for this work. Testing equipment permitting the application of potentials up to about 750,000 volts is being considered. The company has been manufacturing paper-insulated cables for about ten years, but not on so large a scale as its production of rubber-covered cable.

Owing to the increased demand for "Tirex" portable cord, the company is enlarging its manufacturing plant at Cambridge by about 30,000 sq.ft. in connection with this product, chiefly in finishing processes. Additional storage space of about 5,000 sq.ft. is also being provided.

New Equipment Ordered for the Cahokia Station

McClellan & Junkersfeld, Inc., announce the placing of contracts for the pulverizing and combustion equipment for the third unit of Cahokia station with the Combustion Engineering Corporation and the placing of a contract for the weighing and transport system with the Quigley Fuel Systems, Inc. These installations will be substantially duplicates of those now operating in units Nos. 1 and 2 in the first section.

In addition to the foregoing regular equipment, one 70-in. Fuller Engineering Company air-separation pulverizing mill will be installed for comparison and trial purposes.

General Electric's Income Shows Large Increase

The annual report of the General Electric Company for the year ended December 31, 1923, shows that orders received during the year were $304,199,746, compared with $242,739,527 in 1922, an increase of 25 per cent. The net income available for dividends was $33,525,118, larger than in any previous year, and compares with $26,231,019 for 1922.

The export business of the company is conducted by the International General Electric Company. Of $700,000 dividends paid by the International during 1923, $669,372 was received by the company and is included in the financial statement as income from investments. The report further states that during the year distinct progress was made in the manufacturing departments. Notable improvements have been made in internal rearrangement and production processes and methods, which, notwithstanding increased cost of labor and material, have resulted in lower costs, and these have been reflected from time to time in reduced selling prices.

Investment securities have increased from $63,892,231 at the end of 1922 to $77,684,401. The increase is due to the purchase of additional securities, such as those of the General Electric Employees' Securities Corporation and the stock of the Canadian General Electric Company, Ltd. Current assets are carried at $83,746,031, compared with $75,334,561 at the end of 1922. Notes and accounts receivable after deducting proper reserves are $37,987,339, compared with $35,154,419 at the end of 1922. Collections are reported as having been good and credit losses very small. The cash balance, including temporary investments in short-term obligations of the United States government, was $91,205,620, compared with $85,341,538 at the close of the previous year. The company has no notes payable, or any obligations bearing its indorsement, outstanding.

Canadian Westinghouse Shows Higher Net Income

The report of the Canadian Westinghouse Company, Ltd., for the year ended December 31, 1923, just published, shows a net income of $1,021,473 after deduction of depreciation, taxes, etc., as compared with a net income of $742,195 on the same outstanding capital stock for 1922. The surplus for the year was $278,683, as against $148,263 in 1922, a total surplus of $2,891,364 as compared with $2,612,681 for 1922.

Delco Products Sales Office to Move May 1

After May 1 the New England sales offices of the Home Electric Light & Power Equipment Company, representing Delco Light products and the "Frigidaire" electrically driven line of refrigerating apparatus, will be at 101 Franklin Street, Boston. Temporary quarters since a recent fire are being maintained at 95 Broad Street, Boston.

The Ideal Electric & Manufacturing Company, Mansfield, Ohio, announces the opening of an office in room 1905, Oliver Building, Pittsburgh. W. M. McKee will be in charge of the office and Thad L. Farnham will travel the territory.

The Locke Insulator Corporation, Baltimore, has awarded a general contract to J. Henry Miller, Inc., Franklin Street, for the erection of two additions to its plant at Charles and Cromwell Streets, 50 ft. x 410 ft. and 80 ft. x 380 ft., to cost about $50,000. Work will be placed under way at once.

The Paramount Lamp Company, Inc., New York, a jobbing firm handling incandescent lamps exclusively, has just been incorporated with a capital stock of $50,000 in fifty-dollar shares, all of which capital has been subscribed. The company has been doing business for some time entirely outside of New York City.

New Equipment Available

Short Descriptions of New Apparatus and Accessory Equipment of Interest to the Electrical Industry and Available from Manufacturers and Announcements of New Lines

Safety Plug Puller and Switch Hook

A combination safety plug puller and switch hook suitable for use on 7,500-volt circuits has been developed by the General Electric Company for opening and closing the circuit of insulator and expulsion-type cut-outs for renewing fuses or other operations. The device consists of a slot and spring holder, mounted on the end of a treated maple pole. The enlarged portion of the slot is slipped over the knob of the plug, which is then guided by means of the spring, after which, with a slight side push into the narrow part of the slot, it is securely held by the spring. The puller is removed from a plug by a slight upward pressure and side push. A standard switch hook mounted at the other end of the pole is designed to operate such expulsion-type cut-outs as are equipped with ring handles for this purpose.

High-Capacity Ground Connectors

A ground connector of low resistance and capable of carrying very heavy currents has been developed by the Groundulet Company, Newark, N. J. Various types of these ground connectors are available.

Type M consists of a brass cap, which screws onto the top of a 2-in. driven ground pipe, to which may be bolted any number of a set of disks. These disks are made in two halves and provided with holes of different diameters so that various sizes of ground cables can be clamped between them. In addition, lugs may be bolted on the topmost disk. The fittings are tinned and fitted with ⅝-in. bronze bolts. The type EB & S is a very heavy bronze fitting, also arranged for screwing on a 2-in. pipe, and is shaped like a cast lug with a heavy bronze plate bolted to each side. A 3-in. busbar, large soldering lugs, or any size wire up to 1,000,000 circ.mil, can be clamped to this fitting. For making connections to water piping systems other types of fittings are available. These are made in sizes to fit water piping from ½ in. to 6 in. and for use on conduit up to 1¼ in.

Primary Battery

A new primary battery has been developed by the Le Carbone Company, Paris, France, and is obtainable through its agent, W. J. Jeandron, 345 Madison Avenue, New York. The elements of the battery consist of a carbon electrode, positive, and a zinc electrode, negative, in a concentrated solution of ammonium chloride and utilizing the oxygen of the air as a depolarizer. The carbon element is extremely porous and of a cellular structure, is impervious to liquid, but will freely admit gases. During the process of discharge the hydrogen given off at the zinc electrode is absorbed by the carbon electrode, where it combines with oxygen from the air and forms water, which in turn is passed back into the cell, thus cleansing the surface of the carbon and preventing polarization.

When first put in service a peak voltage is obtained which very rapidly diminishes during the first twenty-four hours, and thereafter what may be considered as the working voltage is maintained during the ampere-hour life of the cell at between 0.95 volt and 0.75 volt. The rapid recuperation of voltage is one of the cell's chief characteristics.

Totalizing Recording Wattmeter

A direct-acting totalizing recording wattmeter that operates on the induction principle has been developed by the General Electric Company and is known as the type C-12. The moving elements consists of a shaft approximately 36 in. in length on which are mounted four metallic disks. Grouped around these disks are sixteen split-phase torque-producing elements, making it possible to totalize any number of polyphase circuits from two to eight. A strip chart, 6 in. in width, is employed, and the record is made with a siphon type of pen connected through a simple link to the moving element. The high torque of this instrument makes it available for operating remote indicators, a complete line of which is now available for use with these instruments.

Condex Park Cable

A new flexible armored cable for use on series street lighting circuits has been developed by the Simplex Wire & Cable Company, Boston, under the name "Condex Park cable." It consists of an insulated lead-covered conductor protected by a flexible interlocking steel tape applied spirally around the conductor, with a bedding between the lead and the steel tape and an outer covering of jute. A preservative compound is applied over the lead and between the various layers, covering the entire surface of the steel as well and working itself into the overlapping, locking feature to insure the flexible conduit against rusting. The steel completely covers the cable under all conditions, and as the overlapping is arched in form, unusual resistance to crushing is afforded. Neither underground conduits nor manholes are necessary in laying this product, which can be laid in a shallow trench or in the bedding under a single course of paving blocks.

Pipe-Threading Machine.—A portable pipe-threading, cutting-off, chamfering and reaming machine, known as the "Willie Williams," has been developed by the Williams Tool Corporation, Twelfth and Liberty Streets, Erie, Pa. The machine is demountable, has a self-contained grinder and can be driven by motor, belt or hand. It can handle pipe from ⅛ in. to 2 in. and bolts from ⅜ in. to 1½ in. inclusive. The longest-run thread at one chucking is 10½ in.

New Trade Literature

SUCTION SWEEPERS.—A new booklet has been published by the Hoover Suction Sweeper Company, North Canton, Ohio, entitled "I Am Your Business," designed primarily for the prospective "Hoover" dealers. It contains a chart compiled by the National Dry Goods Association, which gives the average annual turnovers of forty-two departments in department stores. It also includes a comparison of the effectivness of the two plans followed by dealers in selling "Hoovers" and contains some very interesting actual figures on costs.

STATIC CONDENSERS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a new publication entitled "Static Condensers for Power-Factor Correction," known as circular No. 1,670, in which the need for power factor correction and the method of obtaining high power factor are discussed.

HIGH-VOLTAGE INSULATORS.—"High-Voltage Porcelain Insulators—Their Design and Manufacture" is the title of a booklet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which gives information describing the design and manufacture of porcelain insulators.

TRANSFORMER DATA. — The Moloney Electric Company, St. Louis, is distributing No. 1 of a series of bulletins to be issued monthly, entitled "Moloney Transformer Data," containing technical information.

ELECTRIC TRUCKS.—The New York Edison Company, Irving Place and Fifteenth Street, New York City, is distributing a folder illustrating the various types of electric trucks. The folder also gives a list of many large users of electric trucks.

WATER SOFTENERS. — Bulletin No. 5051 issued by the Graver Corporation, East Chicago, Ind., covers the "Graver" water softeners for ice plants of 50 tons or less capacity.

CONDUCTOR FITTINGS.—Bulletin No. 109 issued by the Electrical Engineers' Equpiment Company, 708 West Madison Street, Chicago, covers its various conductor fittings for wire, cables, bars, tubings, etc.

SERVICE BOXES. — The Johns-Pratt Company, 160 Huyshope Avenue, Hartford, Conn., is distributing a new leaflet describing the "Noark" service boxes for industrial power-circuit control.

PORTABLE PIPE MACHINE. — The Williams Tool Corporation, Erie, Pa., is distributing a catalog of the "Willie Williams" portable power pipe machine.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Constantinople, Turkey (No. 9,658), of advertising signs.

Purchase and agency is desired in Constantinople, Turkey (No. 9,658), for electrical supplies and dry batteries.

An exclusive agency is desired in Buenos Aires, Argentina (No. 9,655), for electrotherapeutic apparatus.

Purchase is desired in Stockholm, Sweden (No. 9,632), of radio apparatus.

Purchase and agency is desired in Dublin, Ireland (No. 9,656), for radio apparatus and appliances.

Purchase is desired in Penang, Straits Settlements (No. 9,643 and No. 9,649), of electric trucks for railway stations.

An agency is desired in Santiago, Chile (No. 9,657), for domestic, portable ice-making and refrigerating plants.

An agency is desired in São Paulo, Brazil (No. 9,635), for all kinds of electric motors.

Purchase is desired in Durango, Mexico (No. 9,641), of ice-making machinery, complete installation, including a producer-gas power plant.

TENDERS FOR WORK IN CONNECTION WITH THE ARAPUNI (NEW ZEALAND) POWER SCHEME.—Tenders will be received by the Secretary of the Public Tenders Board, Wellington, New Zealand, until April 30 for construction of headworks, and until May 21 for power house and plant. For details see Search-light Section.

ELECTRICAL EQUIPMENT FOR WATERWORKS AT MEHALLA EL KOBRA, EGYPT.—Tenders will be received by the Ministry of the Interior, Cairo, Egypt, until May 31, for equipment for waterworks system at Mehalla el Kobra, including pumps, filters, electric motors, cables, switchboards, tools and plant.

New Incorporations

THE WABASH HYDRO-ELECTRIC COMPANY, Indianapolis, Ind., has been incorporated by John A. Schafer, John H. Barnhart, Samuel W. Thompson, Alfred H. Brewer and Paul C. Kepler. The company is capitalized at $10,000 and proposes to generate and distribute electricity.

THE MOUNT OLIVET ELECTRIC LINE COMPANY, Concord, N. C., has been chartered with a capital stock of $10,000 by C. J. Goodman, B. L. Umberger and others.

THE MOUNT ULLA (N. C.) RURAL ELECTRIC LINE COMPANY has been incorporated by G. A. Brown, J. C. Sherrill and others. The company is capitalized at $25,000.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

GARDNER, MASS.—The Gardner Electric Light Company contemplates the installation of a new 3,750-kva. transformer bank at the Gardner substation, a complete new 2,300-volt double bus with new oil switches, and also a 13,000-volt outdoor bus with three new 13,000-volt oil switches. Carl A. Ware is manager.

HOLYOKE, MASS.—Work, it is said, will be started in May by the Holyoke Water Power Company on the construction of its new overflow hydro-electric plant at the Whiting No. 1 mill.

HOLYOKE, MASS. — Contracts, it is understood, will soon be awarded for a new coal pocket and conveyor, etc., for the municipal electric plant, to cost about $150,000.

TAUNTON, MASS.—Extensions are contemplated to the municipal electric lighting system, including the construction of a high-tension overhead and underground 13,200-volt transmission and distribution service, two substations and one outdoor substation, to cost about $250,000. George F. Seibel is manager.

ROCKY HILL, CONN.—Plans for the local artificial silk works now in course of erection by the Bellamose Corporation, Hartford, include a 1,000-hp. steam-operated electric power plant. The cost is estimated at about $250,000.

Middle Atlantic States

BOLTON LANDING, N. Y.—Permission has been granted to Henry C Knoblauch to extend his electric lighting sytem from Bolton Landing to the towns of Chester and Horicon. Mr. Knoblauch proposes to erect a 23-mile transmission line, to cost about $30,000. It is also proposed to furnish street-lighting service in Chestertown and Pottersville.

BUFFALO, N. Y.—The Buffalo General Electric Company has filed plans for the construction of a substation at 25 Short Street, to cost about $75,000; also, for an addition to the substation at 854 East Ferry Street.

MIDDLETOWN, N. Y.—Bids will be received by the State Hospital Commission until April 23 for a fire-alarm system for the Middletown State Homeopathic Hospital.

PERRY, N. Y.—The Public Service Commission has granted the New York Central Electric Corporation permission to operate high-tension transmission and distribution lines to supply electricity in about thirty-seven towns and villages in Allegany, Livingston, Steuben, Yates, Ontario and Schuyler Counties for which franchises were granted by the village and town boards to the company and to Robert Hayt. The commission has also approved the assignment of about ten franchises originally granted to Mr. Hayt to the corporation. In many of the municipalities covered in the order there is no existing service.

PORT WASHINGTON, N. Y.—Bids will be received by the Board of Water Commissioners until April 9 for extensions to pumping plant, including addition to pumping station, a fuel-oil-engine-driven triplex pumping unit, an automatically controlled motor-driven centrifugal pumping unit, electric wiring in stations, etc. Nicholas S. Hill, Jr., 112 East Nineteenth Street, New York City, is consulting engineer.

ST. GEORGE, N. Y.—The Staten Island Edison Corporation plans extensions in its transmission lines, including rebuilding a portion of the system and installation of substation equipment.

SYRACUSE, N. Y. — Extension of the ornamental lighting system to West Genesee Street from North Clinton to North Geddes Street has been authorized by the City Council.

KERSEY, PA.—The Glen Coal & Clay Products Company contemplates the construction of a power house at its proposed local tile manufacturing plant, to cost about $100,000.

PHILADELPHIA, PA.—The Philadelphia Lumbermen's Exchange, Wilson H. Lear president, in co-operation with other local lumber interests, plans to construct a power plant in connection with a proposed lumber terminal and re-milling plant on Oregon Avenue, to cost about $20,000.

PITTSBURGH, PA. — The Duquesne Light Company plans to build three automatic power substations, on Second Street; at the Phipps power station, Fifth Avenue extension and on Thirteenth Street, respectively; also for extensions in underground lines in the business district and for additional transmission lines from the Brunot Island power plant.

MILLSBORO, DEL. — The Light and Water Commission contemplates the installation of a 75-hp. oil engine and extensions to distribution lines. G. S. Williams is manager.

ANNAPOLIS, MD. — Plans are being considered for the installation of ornamental lamps around the State Circle and Governor's Circle. The system will be installed by the Chesapeake Bay Power Company.

ANNAPOLIS, MD.—The Public Service Commission has given its approval of the franchises recently granted to the Annapolis & Chesapeake Bay County Company to erect transmission lines and cables in Anne Arundel, Howard and Prince Counties.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company has filed plans for an addition to its power house at Race and Barney Streets, to cost about $43,000.

CHARLESTON, W. VA.—The Interstate Power Company has been granted a franchise to extend its transmission lines in Kanawha County.

PRATT, W. VA. — The Montgomery Utilities Company, Charleston, contemplates the construction of a local electric power plant.

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until April 14, for electric accessories and supplies. (Circular CAS 24-90.)

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until April 22, for rotary converters and spare parts, for Eastern and Western yards. (Schedule 2031.)

WASHINGTON, D. C.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 18 for motors, wire cable, vacuum tubes, lightning arresters, divers' telephones, plug caps, vibrating bells, mica carts, etc. (Circular 1600.)

North Central States

RAMSEY, MICH.—The Castile Mining Company plans to construct a power plant in connection with other buildings at its works, to cost about $110,000.

READING, MICH.—The Southern Michigan Light & Power Company is said to have completed negotiations for the pur-

chase of the municipal electric plant and plans to extend its transmission line here.

TRENTON, MICH.—The switch house and the generator room of the new channel plant of the Detroit Edison Company, under construction near Trenton, was recently damaged by fire, causing a loss of about $50,000.

CLEVELAND, OHIO. — Arrangements are being made by William R Hopkins, city manager, for an issue of $500,000 in bonds, the proceeds to be used for additions in the municipal electric plant, including two 15,000-kw. generators, boilers, etc.

BLUFFTON, IND. — Improvements are contemplated to the municipal light and water plant, including the installation of a boiler and heater and the erection of a brick smokestack. Edward R. Hans is superintendent.

COLUMBIA CITY, IND.—The installation of a new 1,000-hp. engine and 750-kw. generator in the municipal light and water plant is under consideration. F. T. Schultz is manager

CRAWFORDSVILLE, IND.—The Crawfordsville Electric Light & Power Company plans to install 150 new street lamp posts this year. H. E. Hayworth is manager.

INDIANAPOLIS, IND. — The Indiana Electric Corporation plans to construct a power plant, to cost about $250,000. Bids for structural-steel superstructure are being asked.

INDIANAPOLIS, IND.—Bids will be received by the Board of Public Works until April 18 for a ten-year street-lighting contract from April 1, 1925. The specifications call for the erection of two-lamp standards in the downtown section of the city.

LAWRENCEBURG, IND.—Extensions are contemplated to the municipal electric light plant during the year, including the installation of a double-acting deep-well pump and a centrifugal fire pump, electric motor and gasoline-driven. V. W. Yingling is superintendent.

LOGANSPORT, IND. — The Wabash Hydro-Electric Company, Indianapolis, recently incorporated, contemplates the construction of a hydro-electric plant on the Wabash River at Logansport.

SOUTH BEND, IND.—The Indiana & Michigan Electric Company is planning to extend its steel-tower transmission system about 8 miles and to install two 35,000-kva. units and auxiliary equipment in its power house.

TIPTON, IND.—The Tipton Electric Light Company contemplates an expenditure of $14,000 on outside construction during this year. Robert E. Staats is manager.

WILLIAMSPORT, IND.—The municipal Light and Water Department is considering the installation of an ornamental lighting system.

ALVIN, ILL.—The Alvin Grain & Electric Company contemplates extension of transmission lines from Bismarck and also into territory near Danville. Frank E. Yeazel is president.

DECATUR, ILL.—Plans are under consideration for improvements to the municipal electric lighting system, including replacing all series arc lamps with alternating-current, constant-current 6.6.-amp. lamps, 400-cp. series-burning lamps. Nine hundred lamps are to be installed. The installation will include eight 50-kva., 2,300-volt, 60-cycle regulators and switchboard equipment; one three-phase, 2,300-volt primary feeder panel and transmission line for parks. About 500 lamp standards will be erected. William Logan Rice is chief electrician.

McLEANSBORO, ILL.—The installation of a 250-kva. generator directly connected to a 300-hp. engine in the municipal electric plant within the next sixty days is contemplated. J. D. Ledbetter is superintendent.

MOLINE, ILL.—The installation of an ornamental lighting system in the business district covering sixteen blocks, is under consideration. Plans as outlined by the People's Power Company provide for the erection of 176 lamps of 600 cp. on the main thoroughfare outside of the business district, 296 lamps of 250 cp. and 218 lamps of 100 cp. in the outlying districts.

SULLIVAN, ILL.—The City Light Department contemplates extensions to the street-lighting system. P. E. Harsh is manager of the municipal electric plant.

ALBANY, WIS. — The Wisconsin River Power Company contemplates erecting a 13,200-volt transmission line from Albany to Evansville, a distance of about 12 miles.

BERLIN, WIS.—Petitions presented by property owners on Spring and Wisconsin Streets for the installation of street lamps have been approved by the City Council.

HUDSON, WIS.—Permission has been granted to the Willow River Power Company to enlarge its dam on the Willow River at Burkhardt.

MILWAUKEE, WIS.—A resolution has been introduced into the City Council authorizing the installation of additional electric lamps along Eleventh and National Avenues.

SLAYTON, MINN. — The City Council has granted the Northern States Power Company a twenty-five-year franchise to operate in Slayton. The company has also been given a contract for street lighting for a period of one year.

BURLINGTON, IOWA.—The Burlington Railway & Light Company is considering the erection of a three-phase, 11,000-volt transmission line from West Burlington to Burlington, about 10 miles of new extensions on three-phase, 60-cycle lines in Burlington, and completion of installation of 1,250-kva. frequency changer in plant. S. N. Jordan is chief engineer.

IDA GROVE, IOWA.—Bids will be received by the Ida Grove Electric Company until April 8 for the erection of a new chimney, 150 ft. high, 6 in. in diameter, either concrete or radial brick. William J. Fawcett is manager.

PRESTON, IOWA.—The Hawkeye Electric Power Company, 220 East Third Street, Davenport, contemplates erecting about 40 miles of transmission lines connecting four small towns. J. T. Marron is president.

OAKES, N. D.—The Midwest Power Company is planning for a number of extensions to its transmission lines in the rural sections in this district.

WOONSOCKET, S. D. — The Schuler Electric Company plans to construct an addition to its power plant, for which bids will soon be asked. The McGraw Company, 515 Fifth Avenue, Sioux City, Iowa, is engineer.

CRETE, NEB.—At an election held recently the proposal to issue $45,000 for improvements to the municipal electric plant was defeated.

FILLEY, NEB.—The Common Council is arranging a bond issue for the installation of an electric lighting system.

SWEDEBURG, NEB.—A special election will soon be held to vote on the proposal to issue $55,000 in bonds for the construction of a transmission line for municipal service.

FREDONIA, KAN.—Bids will be received until April 14 by the City Commissioners for the construction of a municipal electric light plant and distributing system consisting of two 300-hp. Diesel oil engines, generators, switchboard, building, electric distributing lines and street-lighting system. Arthur L. Mullergren, Gates Building, Kansas City, Mo., is consulting engineer.

Southern States

LUCAMA, N. C.—The City Commission has approved a bond issue of $15,000, the proceeds to be used for a municipal electric lighting plant.

HAYNE, S. C.—The Southern Railway Company, Washington, D. C., contemplates the construction of a power house at its proposed local shops, designed to replace car and locomotive works at Gadsden, Ala., recently destroyed by fire, with loss of about $400,000.

DALTON, GA.—The American Thread Company, 260 West Broadway, New York, plans to build a power house at its proposed local mills, on which work is under way, to cost about $1,000,000.

HAZLEHURST, GA.—Arrangements are being made for the installation of a new municipal electric plant, which will be equipped with a 150-kva. oil-engine-driven unit, motor-driven pump and air compressor. It is expected to be completed within ninety days. H. G. Dismuk is superintendent.

MEIGS, GA.—The Municipal Water and Light Department contemplates remodeling the municipal electric plant, building substation and erection of 12 miles of transmission line. H. H. Bouer is superintendent.

MONTEZUMA, GA. — The Montezuma Light & Power Company contemplates the construction of a 500-hp. hydro-electric plant during this year. H. S. Parker is manager.

SOPERTON, GA.—Plans are under consideration to enlarge the local plant. Nothing will be done for some months. W. H. Walden is superintendent.

JACKSONVILLE, FLA.—Extensions are contemplated to the municipal electric plant this year, including the installation of an additional 15,000-kva. unit, rebuilding boilers, installing mechanical burners and forced draft; rebuilding old substations and building three new ones; erection of transmission lines to substations and distribution centers. O. Z. Tyler is superintendent.

MILLVILLE, FLA. — The St. Andrews Lumber Company is planning to build new mills in South Florida and plans to install an 1,875-kva. generating plant. Thomas L. Johnston, Panama City, is chief engineer.

NEW SMYRNA, FLA.—The City Council is considering the installation of an ornamental lighting system on Canal Street.

TAMPA, FLA.—At an election to be held April 22 the proposal to issue $100,000 in bonds for improvements to fire-alarm system will be submitted to the voters.

TAMPA, FLA.—The Sunset Park Company, 214 Ferlita Building, plans to install a street-lighting system on tract of 240 acres in the Old Tampa Bay district, now being developed for residential service. Hiram McElroy, Gidden Building, is engineer.

ZEPHYRHILLS, FLA.—The Zephyrhills Electric Company contemplates the installation of high-voltage supply and substation equipment, etc., and establishing a twenty-four-hour service. L. N. Gilbert is owner.

NASHVILLE, TENN.—Bids will be received by the United States Engineer Office until April 10 for one electric switchboard and accessory apparatus. (Circular 24-442.)

ATHENS, ALA.—The construction of a hydro-electric station in connection with the municipal electric light plant is under consideration by the city officials. J. S. Candle is superintendent.

FAYETTE, MISS.—The City Council is considering extensions in the municipal power plant, to cost about $25,000.

HARRISON, ARK.—The Harrison Electric Company will install a 300-kw. turbine set. V. M. Kellogg is superintendent.

LEWISVILLE, ARK. — The Lewisville Light & Water Company is considering the erection of a 6,600-volt transmission line from Story to Lewisville for twenty-four-hour service. A. T. Ward is owner.

STAMPS, ARK.—A franchise has been granted to S. B. Williams to furnish electricity here.

BATON ROUGE, LA.—Plans for the proposed local hardwood mills to be erected by the Mengel Company, Louisville, Ky., to cost about $1,000,000, include a power house.

FERRIDAY, LA.—The Fisher Body Company, General Motors Building, Detroit, plans to build a power house at its proposed local woodworking plant, to cost about $200,000.

HINTON, OKLA.—The Council is considering plans for the construction of a municipal electric plant and ice factory.

TULSA, OKLA.—Plans for the proposed local cement mill to be erected by the Boether Company, Denver, Colo., to cost about $2,000,000, include an electric power plant with an initial capacity of about 6,000 kw.

ATHENS, TEX.—The Texas Power & Light Company plans to erect a power plant near Athens-Trinidad Cross Roads.

COLEMAN, TEX.—The West Texas Utilities Company, Abilene, has been granted a franchise to extend its transmission lines in different parts of Coleman County.

MARBLE FALLS, TEX.—The proposed cotton mills to be erected for the Marble Falls Textile Mills, to cost about $500,000, include a steam-operated electric power plant.

NACOGDOCHES, TEX. — The Texas Power & Light Company is negotiating for the purchase of the municipal electric plant and plans to extend its transmission line here.

Pacific and Mountain States

LEAVENWORTH, WASH.—The property of the Tumwater Light & Water Company has been acquired by the Washington Coast Utilities Company, Seattle.

SULTAN, WASH. — The Puget Sound Power & Light Company, Seattle, has been granted a permit by the Supervisor of Hydraulics to construct a hydro-electric plant on the Sultan River at Sultan, to cost about $600,000. The plans provide for a development of about 4,000 hp.

TAUNTON, WASH. — The Washington Water Power Company, Spokane, contemplates the erection of a 110,000-volt trans-

mission line from Neppel to Taunton, about 28 miles.

TERREBONNE, ORE.—Permission has been granted H. V. Gates and associates to take 700 cu.ft. per second from Crooked Creek for power purposes.

LONG BEACH, CAL.—The City Council is considering the installation of an ornamental lighting system on Broadway from Livingstone Drive to the flood control channel.

LOS ANGELES, CAL.—At an election to be held in June the proposal to issue $38,000,000 in bonds will be submitted to the voters. Of this amount $24,000,000 will be used for development of electrical system and $6,000,000 for steam-power generating plant. J. A. Griffin is city engineer.

LOS ANGELES, CAL.—The Board of Public Works is considering bids for the erection of an ornamental lighting system as follows: Brooklyn Avenue, 120 concrete posts; Hover Street, 57 pressed-steel posts; Arden Boulevard, 28 concrete posts, and on Shatto Place, 9 concrete posts.

OAKLAND, CAL.—The Pacific Gas & Electric Company has appropriated $800,000 for extensions and betterments in the East Bay District distributing system, including additional underground and overhead lines. A new substation is now being erected at Fiftieth Avenue and East Twelfth Street.

OROVILLE, CAL.—The Middle Feather River Power Company is perfecting plans for its proposed hydro-electric plant on the Middle Fork of the Feather River, about 15 miles from Oroville, to develop about 400,000 hp. The company has contracted with the Pacific Gas & Electric Company to distribute the entire output. William Watson, Quincy, is engineer in charge of surveys.

SAN DIEGO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 15 for a miscellaneous quantity of magnet and underwriters' wire, for the local navy yard. (Schedule 2009.)

STOCKTON, CAL.—The City Council has applied to the State Water Commission for permission to use waters from the Mokelumne River for hydro-electric development and other service. The cost of the project is estimated at $3,250,000.

WESTWOOD, CAL. — The Red River Lumber Company plans to construct a power plant at its proposed local mill, to cost about $450,000.

LAMAR, COL.—Extensions and improvements contemplated to the municipal electric plant this year include an extension to the ornamental lighting system consisting of twenty-four posts and adding 250-hp. installation on transmission line. T. R. Kirby is general manager.

PUEBLO, COL. — Plans are under consideration by the Southern Colorado Power Company for improvements to its system, involving an expenditure of about $400,000. Of this amount $100,000 will be used for extensions, improvements and repair of its distribution system, which covers five counties. Some of the work is already under way.

PUEBLO, COLO.—Improvements to its local mills, involving an expenditure of about $3,000,000 have been approved by the directors of the Colorado Fuel Company, a large part of which will be used for electrical and boiler-house equipment. The work will include a power plant, equipped with a battery of high-pressure boilers and stokers with superheaters, turboblowers, additional generating facilities with turbo-generators, substitution of electrical drives in rolling mills to replace steam power, etc. Contracts for equipment, etc., it is understood, will be let this spring.

Canada

VANCOUVER, B. C.—The Powell River Company, Ltd., is perfecting plans for extensions in its hydro-electric plant on the Powell River, to increase the capacity from 24,400 hp. to 50,000 hp. The present dam will be increased about 15 ft. in height.

VICTORIA, B. C.—The British Columbia Electric Railway Company has rejected bids received for the construction of its proposed transmission line along the Humpback Road and will build the line by day labor. It will cost about $35,000.

QUEBEC, QUE.—Additional expenditures for water development have been approved by the Quebec Legislature as follows: For further development of St. Maurice River, $500,000, making a total of $3,000,000, and an additional $950,000 for the development of power at Lake Kenogami, making a total of $2,750,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 18, 1924)

1,486,860. VOLTAGE-REGULATING SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed May 26, 1917. Using a voltage regulator of the Tirill type.

1,486,861. VOLTAGE REGULATOR; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. Of the vibratory type for maintaining substantially constant supply-circuit voltage.

1,486,863. CONTINUOUSLY LOADED SIGNALING CONDUCTOR; O. E. Buckley, Maplewood, N. J. App. filed Aug. 16, 1921. For submarine cable.

1,486,864. CONTROL APPARATUS; L. W. Chubb, Edgewood Park, Pa. App. filed June 9, 1919. Liquid rheostat.

1,486,866. SOUND PRODUCER; L. de Forest, New York, N. Y. App. filed Aug. 20, 1918. Eliminating the necessity of the use of diaphragms.

1,486,868. INTERCOMMUNICATING TELEPHONE SYSTEM; H. C. Egerton, Maplewood, N. J. App. filed May 27, 1920.

1,486,873. ELECTRICAL PROTECTIVE DEVICE; C. Le G. Fortescue, Pittsburgh, Pa. App. filed April 9, 1918. Current-limiting reactors.

1,486,879. FOCUSING FLASHLIGHT; J. Graves, Madison, Wis. App. filed April 24, 1922.

1,486,881. SYSTEM OF CONTROL; A. J. Hall, Wilkinsburg, Pa. App. filed July 19, 1917. Of a plurality of induction motors operated in conjunction with a phase-converting machine and a starting motor therefor.

1,486,882. SYSTEM OF CONTROL; A. J. Hall, Winthcombe, England. App. filed June 9, 1920. Of electric railway motors during both motoring and regenerative periods.

1,486,885. RADIO-DYNAMIC DUPLEX SYSTEM; J. H. Hammond, Jr., Gloucester, Mass. App. filed July 30, 1915. Methods for controlling electric currents in receiving stations operated by radiant energy for the purpose of receiving or recording signals or messages.

1,486,886. SYSTEM FOR TELEDYNAMICALLY CONTROLLING MOVING BODIES; J. H. Hammond, Jr., Gloucester, Mass. App. filed June 3, 1914. Adapted for use in connection with torpedo boats, etc.

1,486,887. ELECTRO-RADIANT SIREN; J. H. Hammond, Jr., Gloucester, Mass. App. filed July 13, 1914. Means for transmitting radiant energy in the form of siren waves.

1,486,889. COMBINED FREQUENCY CHANGER AND PHASE CONVERTER; R. E. Hellmund, Swissvale, Pa. App. filed March 31, 1919.

1,486,890. ELECTRICAL SYSTEM; R. E. Hellmund, Pittsburgh, Pa. App. filed June 18, 1919. For train-lighting systems using motor-generator set.

1,486,892. TRANSMITTING DEVICE; R. R. Herrmann, St. Paul, Minn. App. filed Jan. 24, 1922. For use in telephone circuits.

1,486,893. COLLECTOR RING; W. H. Himes, Pittsburgh, Pa. App. filed May 11, 1921. For dynamo-electric machines.

1,486,900. MEASURED-SERVICE PARTY-LINE TELEPHONE SYSTEM; E. Jacobsen, New York, N. Y. App. filed March 13, 1919. Automatic system.

1,486,901. MOTOR-CONTROL SYSTEM; H. D. James, Edgewood Park, Pa. App. filed March 13, 1920. Using resistors in series with auto-transformer coils for starting induction motor.

1,486,909. MEANS FOR CONTROLLING THE FIRE OF AUTOMATIC GUNS CARRIED BY AIRCRAFT; O. D. Lucas, London, England. App. filed Sept. 29, 1922.

1,486,929. FREQUENCY-CHANGER SYSTEM; J. Slepian, Wilkinsburg, Pa. App. filed April 18, 1919. For railway electrification.

1,486,938. ELECTROMAGNET; E. B. Thurston, Toledo, Ohio. App. filed Feb. 14, 1919.

1,486,955. ELECTRODE ELEMENT FOR GALVANIC BATTERIES AND METHOD OF PRODUCING THE SAME; Le Roy A. Dunham, Bloomfield, N. J. App. filed Feb. 21, 1922.

1,486,971. LOOM PLATE FOR ELECTRIC FIXTURES; P. Lesnesky, Detroit, Mich. App. filed June 12, 1922. Adjustable without the use of bolts, etc.

1,486,982. TELEPHONE-EXCHANGE SYSTEM; F. R. McBerty, Galion, Ohio. App. filed March 15, 1920. Machine switching.

1,486,990. PROCESS AND DEVICE FOR STABILIZING ELECTRIC ARCS; W. Siebert, Laudenburg, Switzerland. App. filed May 13, 1922. In electric furnaces.

1,486,994. SIGNAL FOR WEIGHING SCALES; E. G. Thomas, Toledo, Ohio. App. filed Oct. 13, 1917. To point out the need for adjustment should it be out of level beyond an allowable degree.

1,486,999. TROLLEY CONTACT; A. W. Williams, Bolivar, Pa. App. filed May 4, 1923.

1,487,002. AUTOMOBILE SWITCH; J. L. Adams, Jr., Wilkinsburg, Pa. App. filed Sept. 8, 1914. To control starting, lighting and ignition systems.

1,487,012. CALLING ARRANGEMENT FOR SIGNALING; H. Chireix, Paris, France. App. filed Aug. 29, 1921. Adaptable to wireless telephony and telegraphy.

1,487,055. WATER HEATER; W. C. Garner, Seattle, Wash. App. filed Dec. 23, 1922. Heating element arranged in a boiler and removable so that gas may be substituted.

1,487,096. ELECTRICAL CONDENSER; L. F. Fuller, Palo Alto, Cal. App. filed June 16, 1919. For use in radio transmission systems.

1,487,108. REGULATING SYSTEM; W. A. Knoop, East Northport, N. Y. App. filed July 31, 1922. Voltage-regulating system employing an electric discharge device used as a repeater.

1,487,109. STORAGE-BATTERY ELECTROLYTE; T. F. Lacy, Sioux City, Iowa. App. filed Feb. 1, 1923. For lead cells.

1,487,111. ELECTROLYTIC TIN; C. P. Linville, Elizabeth, N. J. App. filed Dec. 30, 1920. Refined from impure tin anodes by use of additional agent in the electrolyte.

1,487,112. TELEPHONE-EXCHANGE SYSTEM; G. A. E. Lundell, Chicago, Ill. App. filed Nov. 14, 1919. Manually operated.

1,487,113. MACHINE-SWITCHING TELEPHONE SYSTEM; A. E. Lundell, New York, N. Y. App. filed Dec. 18, 1920. In which provision is made for supplying subscribers with measured service.

1,487,115. INTELLIGENCE SYSTEM; J. L. McQuarrie, New York, N. Y. App. filed Sept. 15, 1921. For translating electrical effects into mechanical movements whereby blind and deaf persons may read.

1,487,117. OUTLET BOX; J. J. Merrill, Ipswich, Mass. App. filed April 12, 1922. For use in wiring old buildings.

1,487,124. ELECTROLYTIC PROCESS; J. R. Stack, Perth Amboy, N. J. App. filed Dec. 30, 1920. For the production of refined tin from impure tin cast in the form of anodes.

1,487,125. PROCESS OF RECOVERING TIN; J. R. Stack, Perth Amboy, N. J. App. filed Jan. 4, 1922. By treatment of complex bullion and alloys.

1,487,136. ELECTROLYTIC REFINING OF TIN; H. H. Alexander, Westfield, N. J. App. filed Dec. 30, 1920.

1,487,152. AUTOMATIC ELECTRICAL CIRCUIT CONTROLLER; E. L. Edwards, Indianapolis, Ind. App. filed April 15, 1920. For X-ray apparatus.

1,487,174. ELECTROLYTIC DEPOSITION OF THORIUM; J. W. Marden, East Orange, and J. E. Conley and T. P. Thomas, Bloomfield, N. J. App. filed July 31, 1922. Directly in metallic form from aqueous solution.

1,487,181. LIGHTING FIXTURE; F. H. Robinson, Bayonne, N. J. App. filed Oct. 31, 1922. Special construction of supporting loop and arrangement of circuit wires.

1,487,193. STARTER FOR INTERNAL-COMBUSTION ENGINES; A. Barenyi, Berlin-Lichterfelde, Germany. App. filed Jan. 13, 1923.

1,487,194. SIGNALING SYSTEM; C. E. Beach, Binghamton, N. Y. App. filed Oct. 9, 1919. Comprising a plurality of signal initiating stations and signal manifesting stations.

1,487,210. STARTING AND IGNITION SYSTEM; H. R. Davies, New York, N. Y. App. filed April 28, 1919. Reducing the total resistance of the primary ignition circuit while the starting motor is in operation.

1,487,221. DEVICE FOR COOLING ELECTRIC MACHINES; P. Ehrmann, Paris, France. App. filed March 28, 1921. By arrangement of laminations.

1,487,235. BATTERY COMPOUND; A. E. Hanson and H. Moe, St. Paul, Minn. App. filed Sept. 9, 1922. Made in dry or solid form adapted to be dissolved in liquid when used in a battery.

1,487,267. TESTING SYSTEM; J. B. Retallack, East Orange, N. J. App. filed May 4, 1921. To maintain a constant current flow in a testing circuit during variations in current flow through the device being tested.

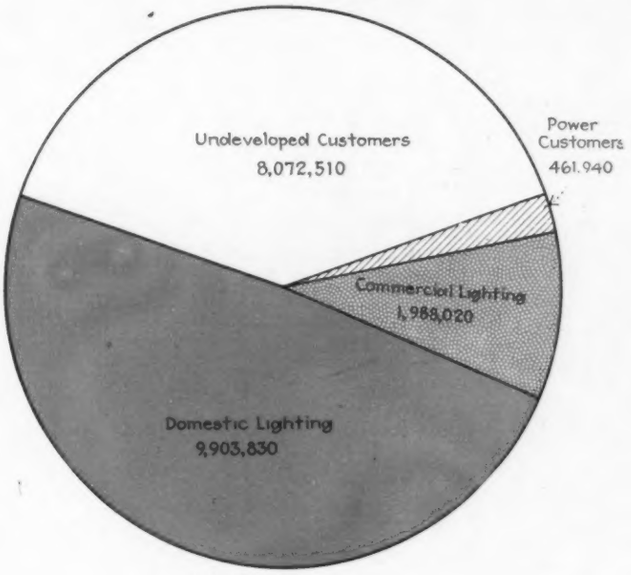
1,487,270. ELEVATOR CONTROL SYSTEM; S. W. Rushmore, Plainfield, N. J. App. filed Aug. 25, 1922.

Business Facts for Electrical Men

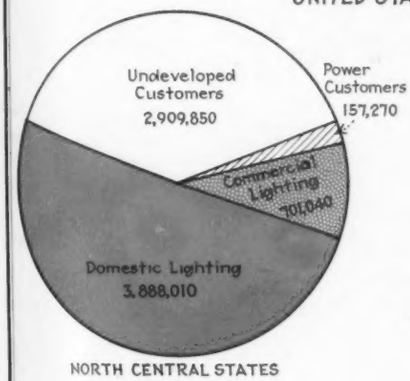
Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

There Are 20,426,300 Potential Customers Within Reach of Central Station Lines, of Which 12,353,790 Have Been Developed

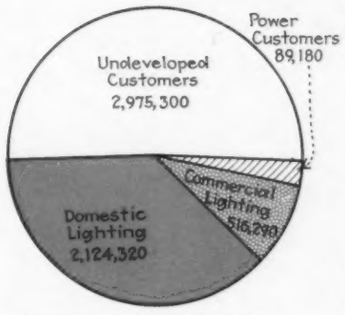
(Data as of Jan. 1, 1923)



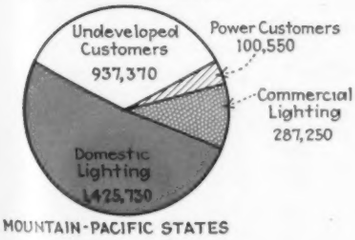
UNITED STATES



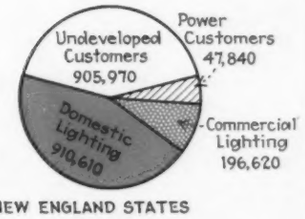
NORTH CENTRAL STATES



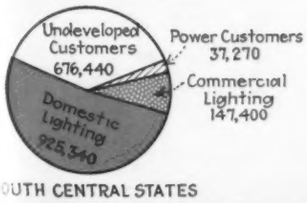
MIDDLE ATLANTIC STATES



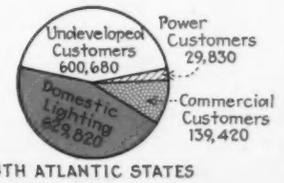
MOUNTAIN-PACIFIC STATES



NEW ENGLAND STATES



SOUTH CENTRAL STATES



SOUTH ATLANTIC STATES

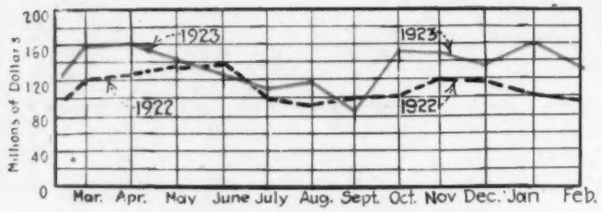
Plenty of Room for Growth

IT IS entirely possible for men to become so bound up in their own environment that the possibility of there being an entirely different state of affairs in the outside world is beyond their comprehension. We who have come to look on the electric light and motor-driven apparatus as so essential to our well-being and who daily see its beneficent influence on every hand are apt to feel that the central station has about reached the crest of its growth and that the undeveloped field is small indeed. But a study of such data as are presented in the accompanying diagram will soon dispel any such conclusions. These data are based on information received for each county of the United States, the figures being checked by some important central-station company with service lines extending into that county.

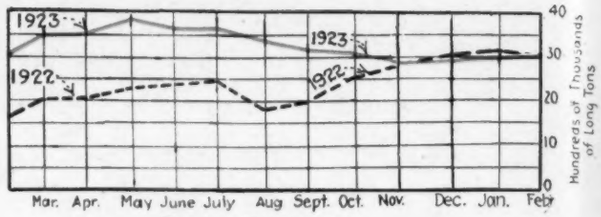
On January 1, 1923, there were estimated to be 8,072,510 undeveloped customers of all kinds within reach of central-station lines. There were 9,903,830 families in the country living in electrically lighted dwellings, whereas there were in the nation a total of 24,351,676 families according to the 1920 Census. At the present time there are estimated to be about three million more telephones and about the same number more registered automobiles in the country than there are families using electric lights. These figures are highly significant, bringing out very clearly the fact that the central-station field is far from being saturated.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

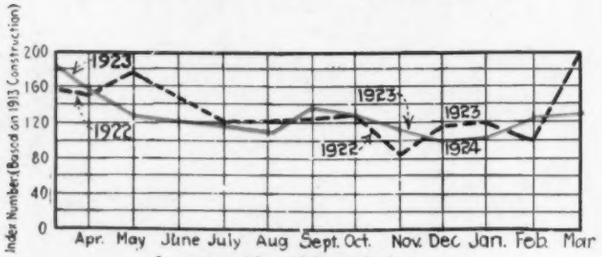
How the Primary Industries Are Trending



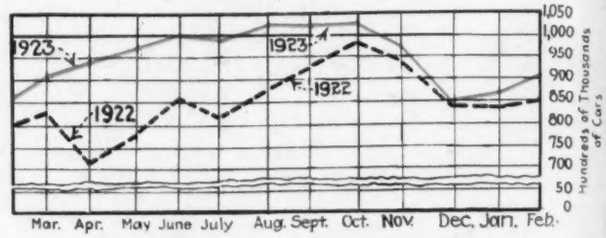
Contracts Awarded for Residential Buildings



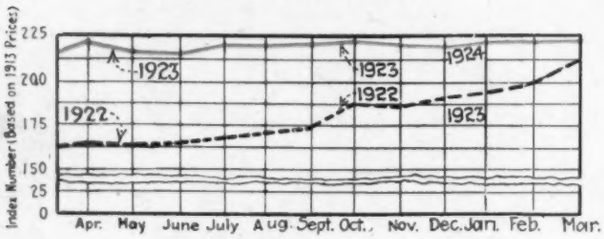
Pig-Iron Production



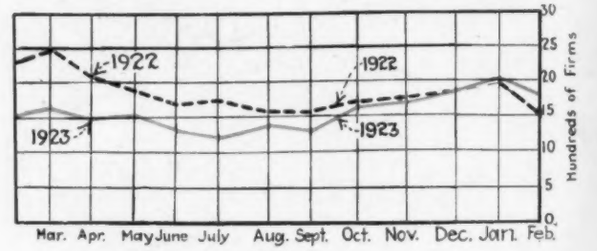
Construction Volume Index
(Engineering News - Record)



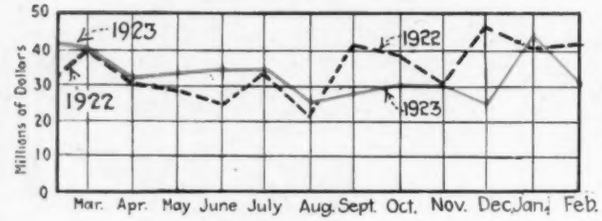
Total Average Weekly Freight-Car Loadings



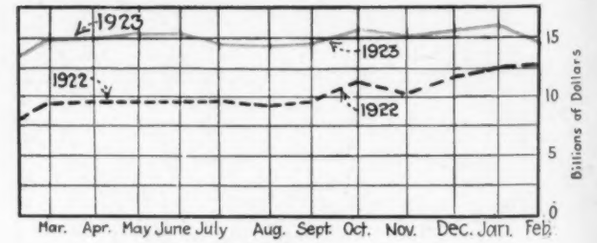
Construction Cost Index
(Engineering News-Record)



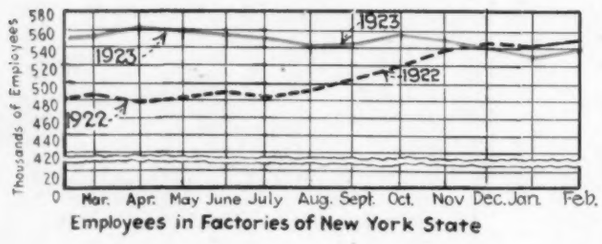
Business Failures



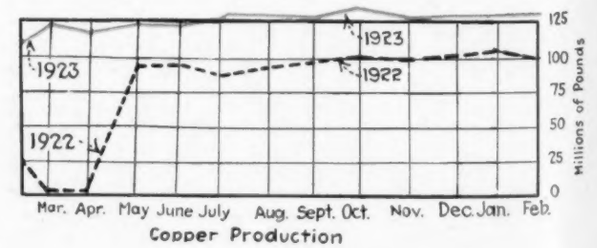
Fire Losses



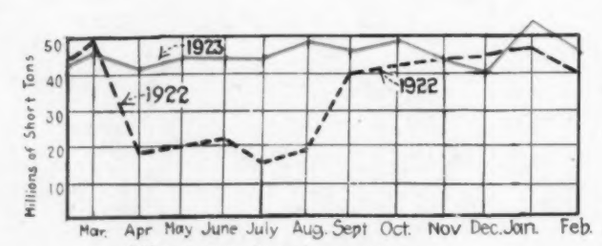
Bank Clearings
(Outside of New York City)



Employees in Factories of New York State



Copper Production



Bituminous Coal Production

Business Continues to Improve

THE upward industrial movement which was so pronounced in January continued through February and the outlook for the first half of the year remained favorable. Building continues very active, and operations in the iron and steel industry, that great barometer of general business, were 13 per cent above January.